PROCESSED CSMIP STRONG-MOTION RECORDS FROM THE NORTHRIDGE, CALIFORNIA EARTHQUAKE OF JANUARY 17 1994: RELEASE NO. 1

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Report No. OSMS 94-06B

California Strong Motion Instrumentation Program

California Department of Conservation

Division of Mines and Geology

Office of Strong Motion Studies

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INTRODUCTION

The digitized and processed records obtained from 5 CSMIP stations during the Northridge earthquake of January 17, 1994 are included in this first release. Four of these stations are in the epicentral area and one is in Santa Monica. They range in distance from 9 to 24 km from the estimated epicenter at 34.219°N, 118.538°W. The stations are:

- Sylmar - County Hospital Parking Lot Sta. # 24514, 15 km
- Pacoima Dam - Downstream Sta. # 24207, 18 km
- Newhall - LA County Fire Station Sta. # 24279, 19 km
- Arleta - Nordhoff Ave Fire Station Sta. # 24087, 9 km
- Santa Monica - City Hall Grounds Sta. # 24538, 24 km

Information on the earthquake and recording stations are given in the 5 Quick Reports (OSMS 94-01, -02, -03, -04 and -05) and more details will be provided in the full report on all CSMIP records to be completed in mid February. This processed data report is a more detailed version of OSMS 94-06A that was released on February 4, 1994. Details on accelerogram digitizing and processing will be presented in a forthcoming final CSMIP processed data report.

PLOTS OF PROCESSED DATA

For each ground-response station the plots are numbered in the upper right corner of each page. The first page for each station is given below as:

Page No.	Station Name
4	Sylmar - County Hospital Parking Lot
13	Pacoima Dam - Downstream
22	Newhall - LA County Fire Station
31	Arleta - Nordhoff Ave Fire Station
40	Santa Monica - City Hall Grounds

The order of the plots for each station is as follows:

1. Phase 1 (Vol. 1) data: Uncorrected accelerations. Acceleration for the first 30 seconds is plotted with a common scaling factor for all channels; three channels are plotted on one page. This plot is followed by a second plot of the full processed length (in general, 60 seconds) with each channel individually scaled.

2. Phase 2 (Vol. 2) data: Instrument and baseline-corrected acceleration, velocity and displacement. The data for the first 30 seconds are plotted with equal scaling for all channels. The filter frequencies determined in the processing are indicated on the plots (see Usable Data Bandwidth).

3. Phase 3 (Vol. 3) data: Response spectra. The pseudo-velocity spectra (PSV), the pseudo-acceleration spectra (PSA), the displacement spectra (SD) and the Fourier amplitude spectra (FS) are presented on a tripartite

logarithmic plot for each channel for 0%, 2%, 5%, 10%, and 20% dampings. The spectra are plotted for periods within the Usable Data Bandwidth.

4. Phase 3 (Vol. 3) data: Response spectra. The absolute acceleration spectra (SA) for 0%, 2%, 5%, 10% and 20% dampings are plotted against period with linear-linear scaling from 0 to 4 seconds.

REFERENCES

CSMIP Staff (1994a). First quick report on CSMIP strong-motion data from the San Fernando Valley earthquake of January 17, 1994, Calif. Dept. of Conservation, Div. Mines and Geology, Office of Strong Motion Studies, Report No. OSMS 94-01, January 17, 1994, 10 p.

CSMIP Staff (1994b). Second quick report on CSMIP strong-motion data from the San Fernando Valley earthquake of January 17, 1994, Calif. Dept. of Conservation, Div. Mines and Geology, Office of Strong Motion Studies, Report No. OSMS 94-02, January 18, 1994, 15 p.

CSMIP Staff (1994c). Third quick report on CSMIP strong-motion data from the Northridge/San Fernando Valley earthquake of January 17, 1994, Calif. Dept. of Conservation, Div. Mines and Geology, Office of Strong Motion Studies, Report No. OSMS 94-03, January 19, 1994, 16 p.

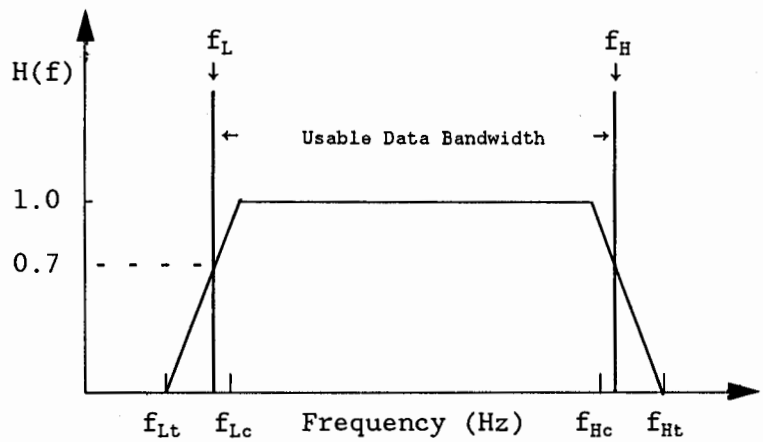
CSMIP Staff (1994d). Fourth quick report on CSMIP strong-motion data from the Northridge/San Fernando Valley earthquake of January 17, 1994, Calif. Dept. of Conservation, Div. Mines and Geology, Office of Strong Motion Studies, Report No. OSMS 94-04, January 21, 1994, 31 p.

CSMIP Staff (1994e). Fifth quick report on CSMIP strong-motion data from the Northridge/San Fernando Valley earthquake of January 17, 1994, Calif. Dept. of Conservation, Div. Mines and Geology, Office of Strong Motion Studies, Report No. OSMS 94-05, January 25, 1994, 8 p.

Darragh, R., T. Cao, C. Cramer, M. Huang and A. Shakal (1994). Processed CSMIP Strong-Motion Records from the Northridge, California Earthquake of January 17, 1994: Release No. 1, Calif. Dept. of Conservation, Div. Mines and Geology, Office of Strong Motion Studies, Report No. OSMS 94-06A, February 4, 1994, 11 p.

DEFINITION OF USABLE DATA BANDWIDTH

The filter bands for each record are indicated on the plots for the Phase 2 and Phase 3 data. In standard processing, the digitized data are processed and filtered using Ormsby filters. The data are first low-pass filtered using a high-frequency filter with a corner frequency of 23 Hz and a roll-off termination frequency of 25 Hz. Then the data are high-pass filtered using a low-frequency filter with a corner frequency of 0.07 Hz and a roll-off termination of 0.05 Hz. Therefore, the Phase 2 data is the result of the digitized data being filtered by the bandpass filter H(f) with ramps as shown in the figure:



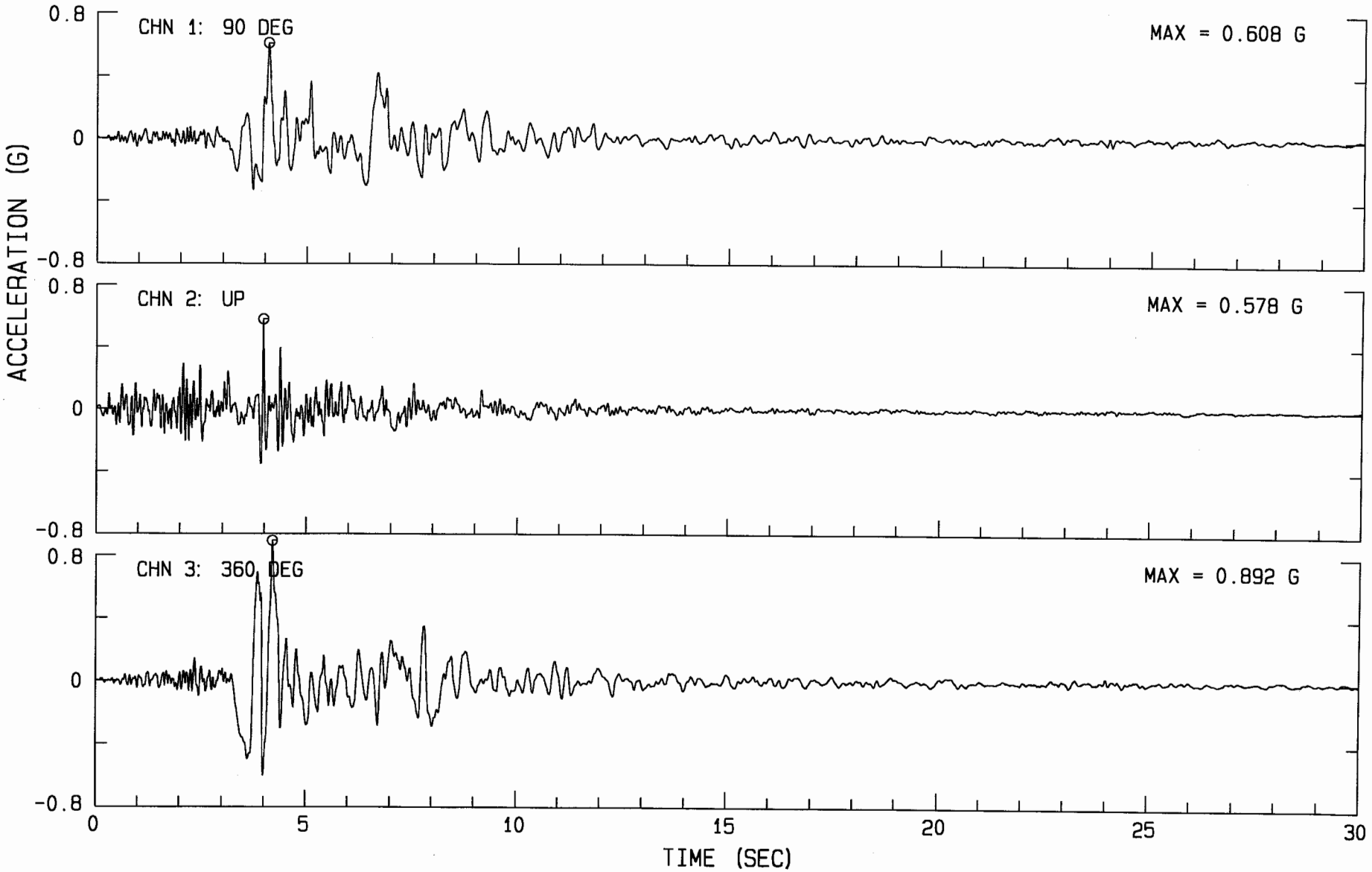
The Usable Data Bandwidth is defined as the band between frequencies f_H and f_L, where f_H and f_L are the -3 dB points on the high-frequency and low-frequency ramps, respectively. The value of H(f) is approximately equal to 0.7 for -3 dB (see Notes). The user should only use these data for analyses within this bandwidth.

Notes:

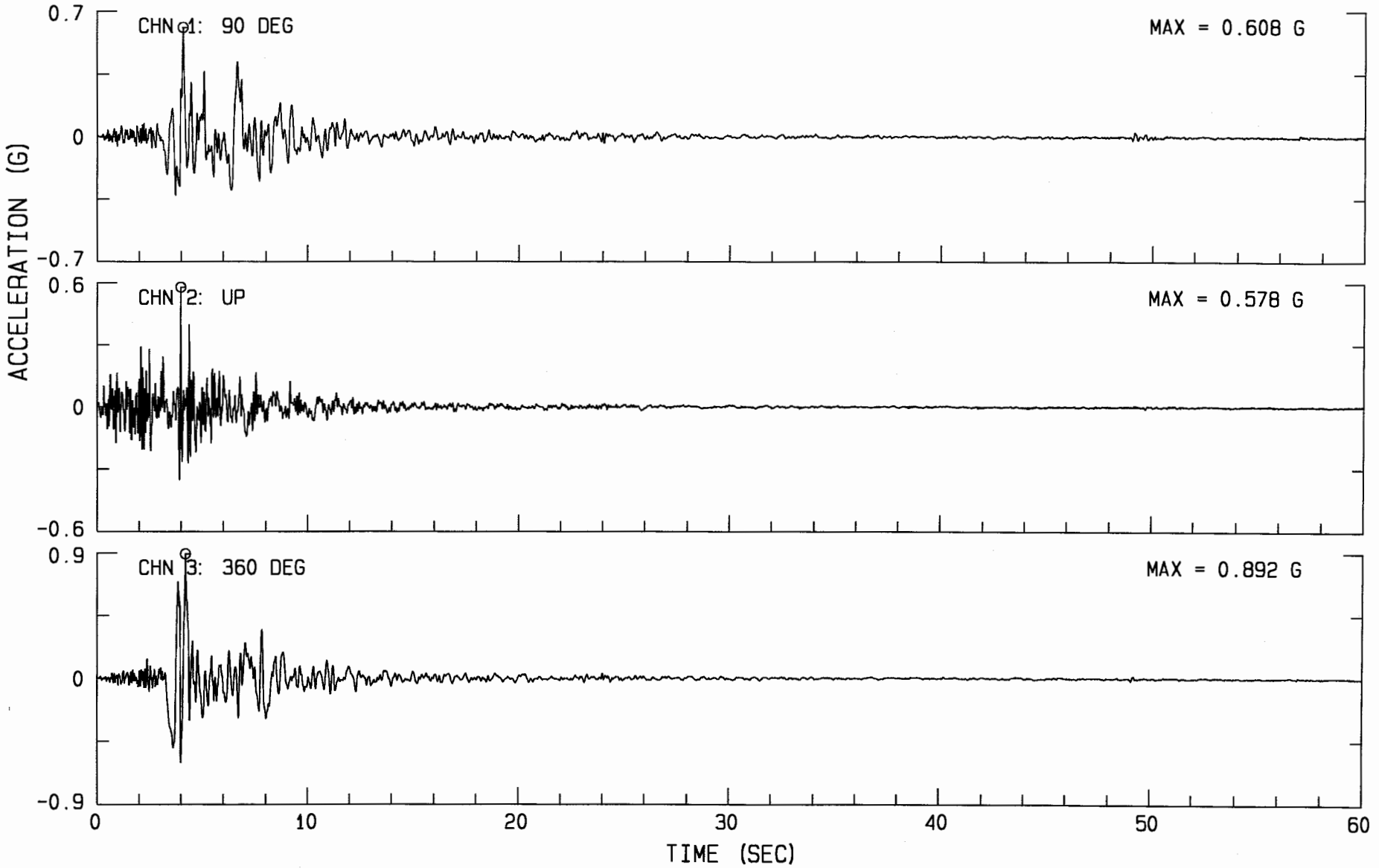
1) The values of f_H and f_L can be calculated from the corner frequencies (f_{Hc}, f_{Lc}) and the roll-off termination frequencies (f_{Ht}, f_{Lt}) used in the processing by using the formulas $f_H = f_{Hc} + 0.3 * (f_{Ht} - f_{Hc})$ and $f_L = f_{Lc} - 0.3 * (f_{Lc} - f_{Lt})$. For example, the Usable Data Bandwidth for data bandpass-filtered with ramps at 0.30 to 0.60 Hz and 23.0 to 25.0 Hz is 0.51 Hz to 23.6 Hz (0.042 to 2.0 seconds period).

2) It is common in signal processing to plot 20 $\log_{10}[H(f)]$ versus frequency, and express the ordinate value in decibels (abbreviated dB). Accordingly, 0 dB corresponds to a value of H(f) equal to 1; 20 dB is equivalent to H(f) = 10, and -20 dB corresponds to H(f) = 0.1. Thus, at the -3 dB frequency point, the amplitude of the transfer function, H(f) is reduced to 0.7, while the power transmitted by the filter, $H^2(f)$, is reduced to 0.5.

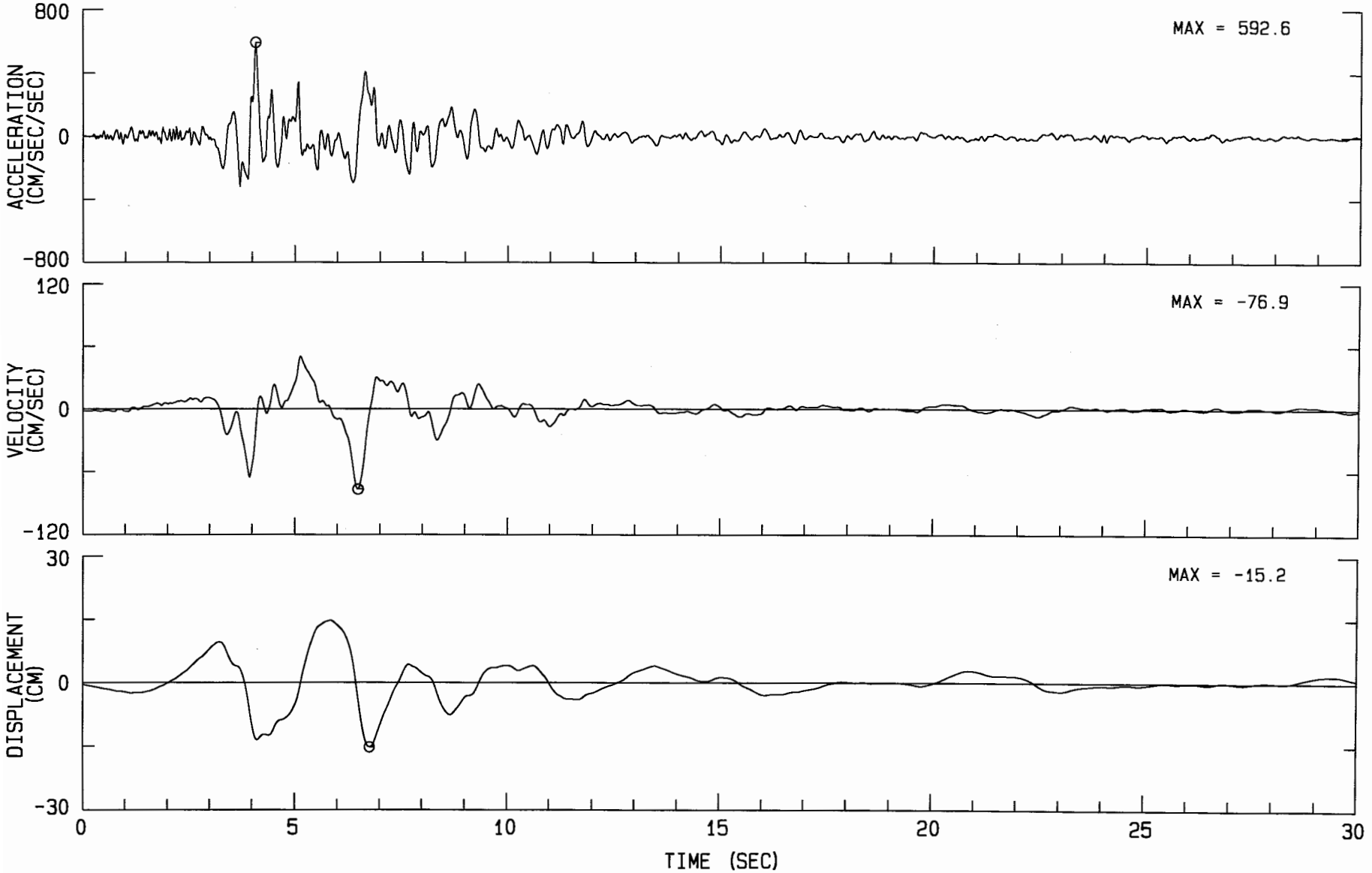
NORTHRIDGE EARTHQUAKE JANUARY 17, 1994 04:31 PST
SYLMAR - COUNTY HOSP. PARKING LOT
UNCORRECTED ACCELEROGRAM 24514-S5254-94017.03 013194.0821-QN94A514



NORTHRIDGE EARTHQUAKE JANUARY 17, 1994 04:31 PST
SYLMAR - COUNTY HOSP. PARKING LOT
UNCORRECTED ACCELEROGRAM 24514-S5254-94017.03 013194.0821-QN94A514



NORTHRIDGE EARTHQUAKE JANUARY 17, 1994 04:31 PST
SYLMAR - COUNTY HOSP. PARKING LOT CHN 1: 90 DEG
INSTRUMENT-CORRECTED AND BANDPASS-FILTERED ACCELERATION, VELOCITY AND DISPLACEMENT
FILTER BAND: .06-.12 TO 23.0-25.0 HZ. 24514-S5254-94017.03 020394.1803-QN94A514



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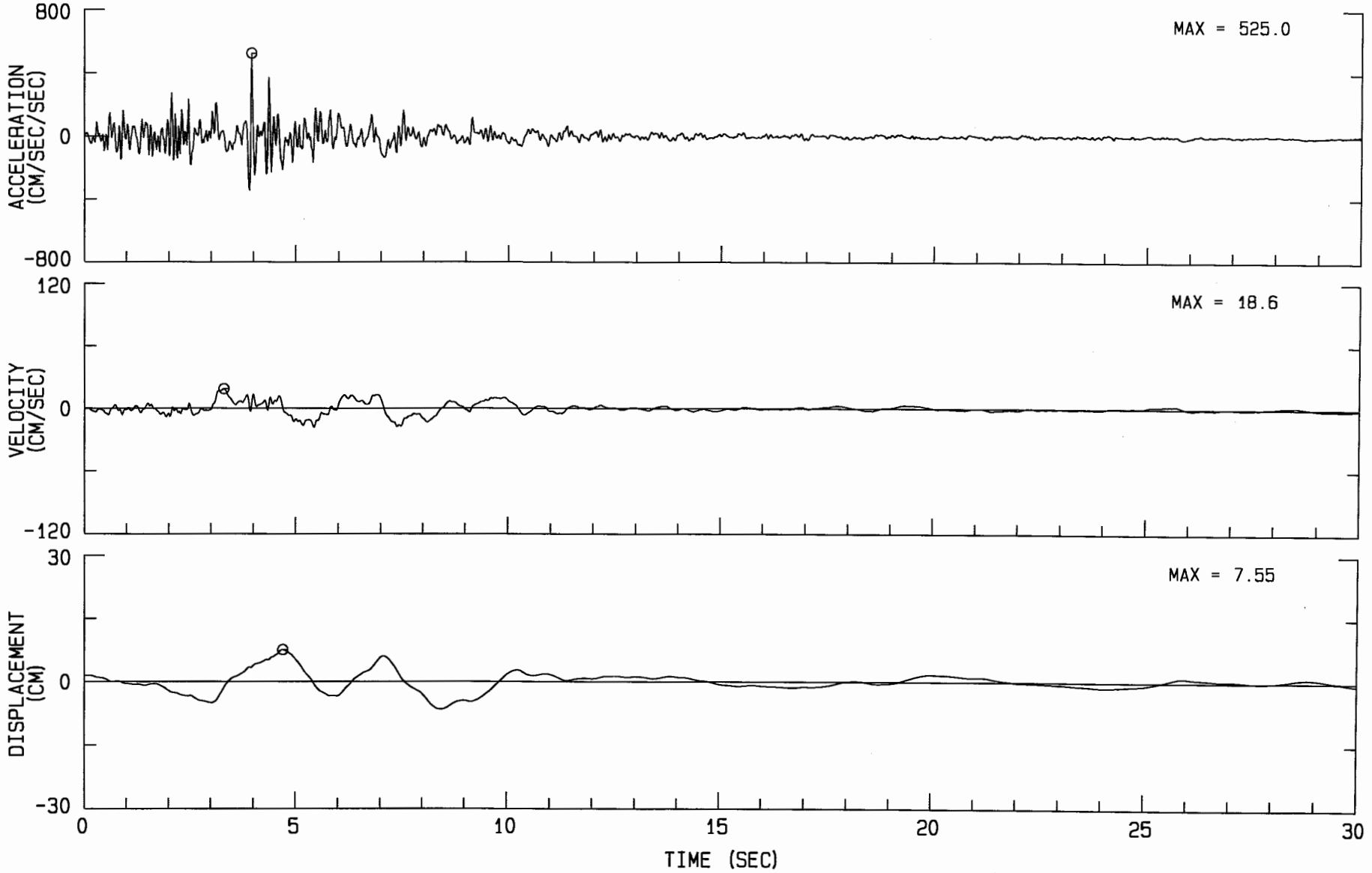
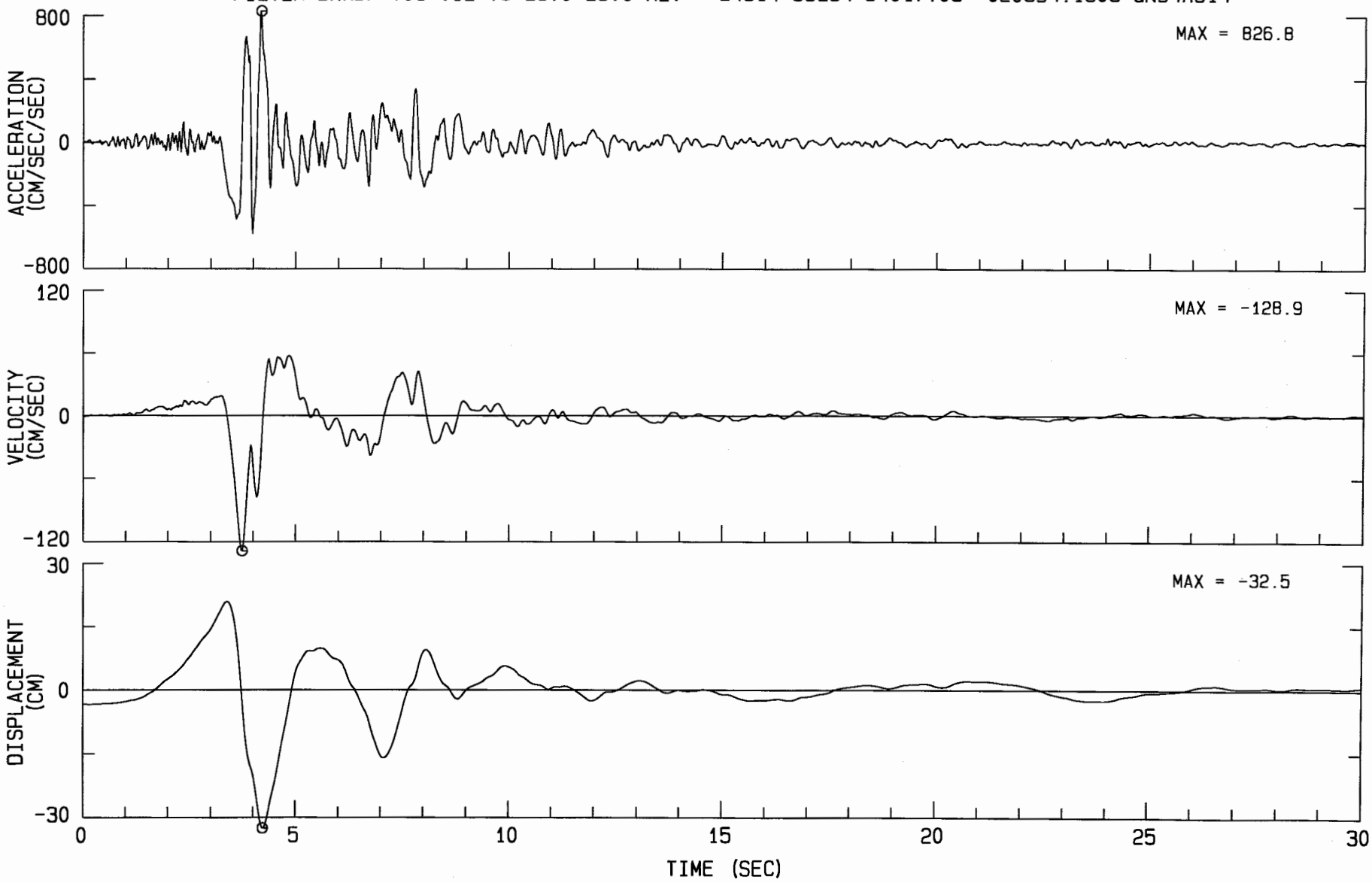
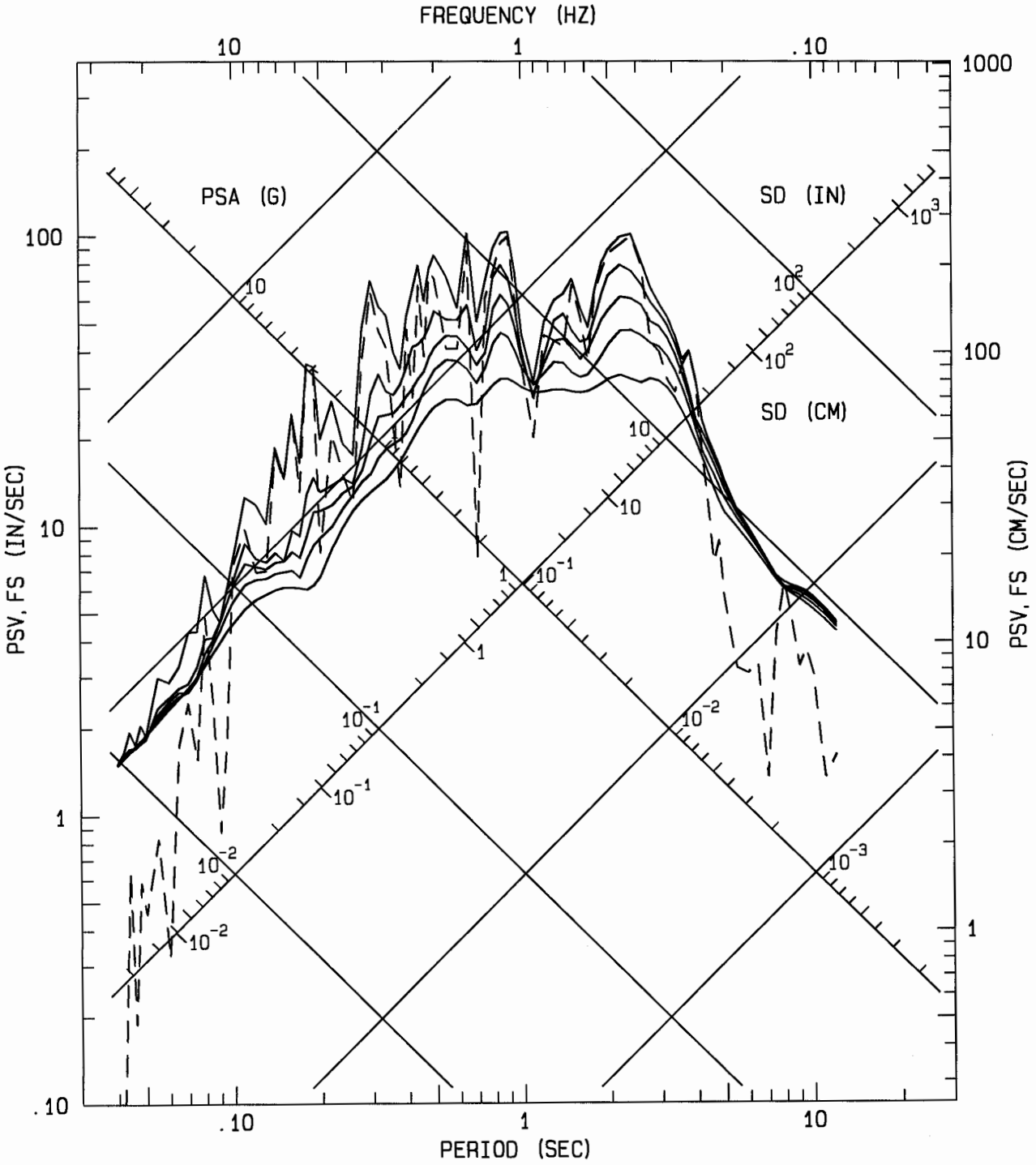
SYLMAR - COUNTY HOSP. PARKING LOT CHN 2: UP
INSTRUMENT-CORRECTED AND BANDPASS-FILTERED ACCELERATION, VELOCITY AND DISPLACEMENT
FILTER BAND: .06-.12 TO 23.0-25.0 HZ. 24514-S5254-94017.03 020394.1803-QN94A514



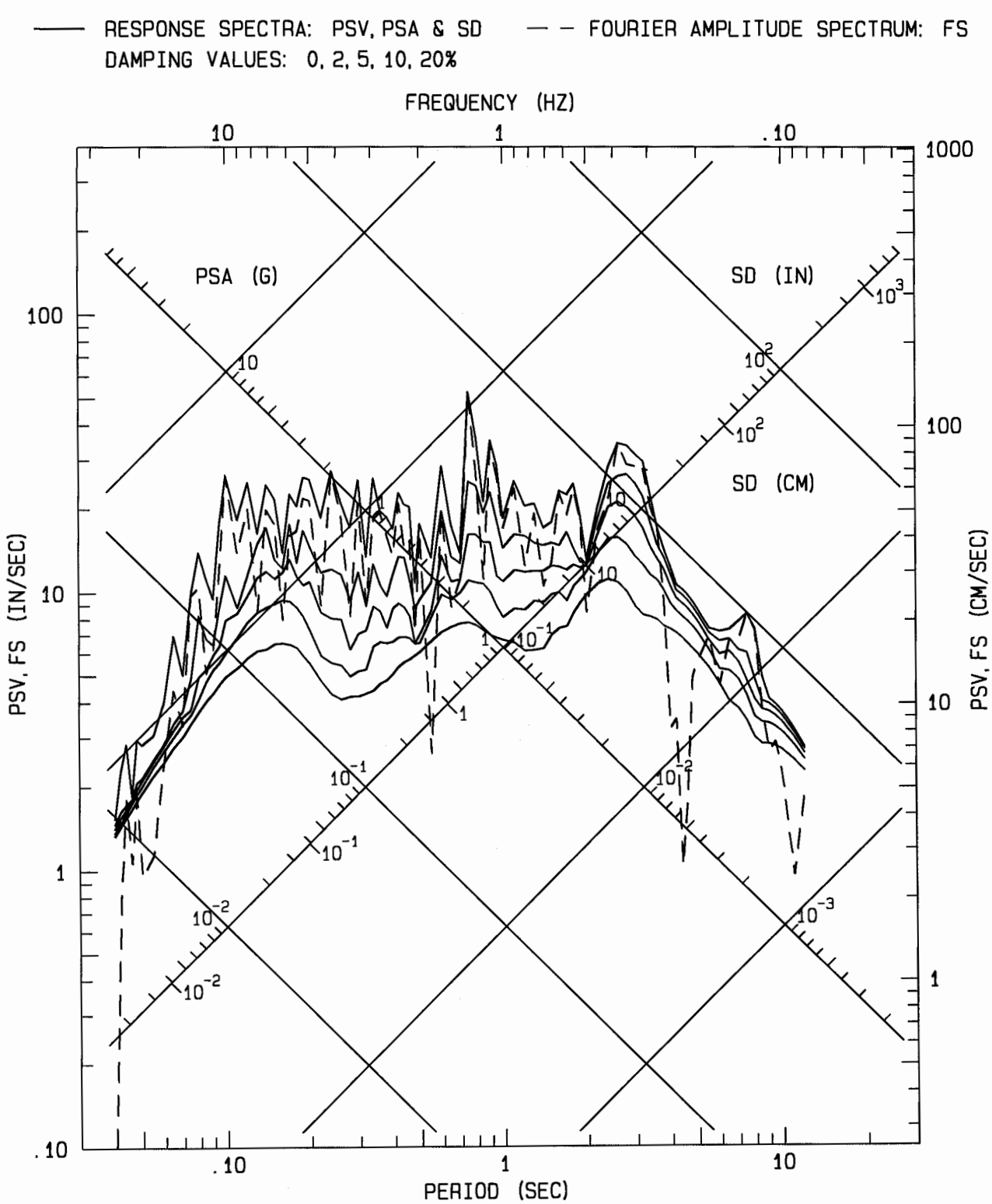
NORTHRIDGE EARTHQUAKE JANUARY 17, 1994 04:31 PST
SYLMAR - COUNTY HOSP. PARKING LOT CHN 3: 360 DEG
INSTRUMENT-CORRECTED AND BANDPASS-FILTERED ACCELERATION, VELOCITY AND DISPLACEMENT
FILTER BAND: .06-.12 TO 23.0-25.0 HZ. 24514-S5254-94017.03 020394.1803-QN94A514



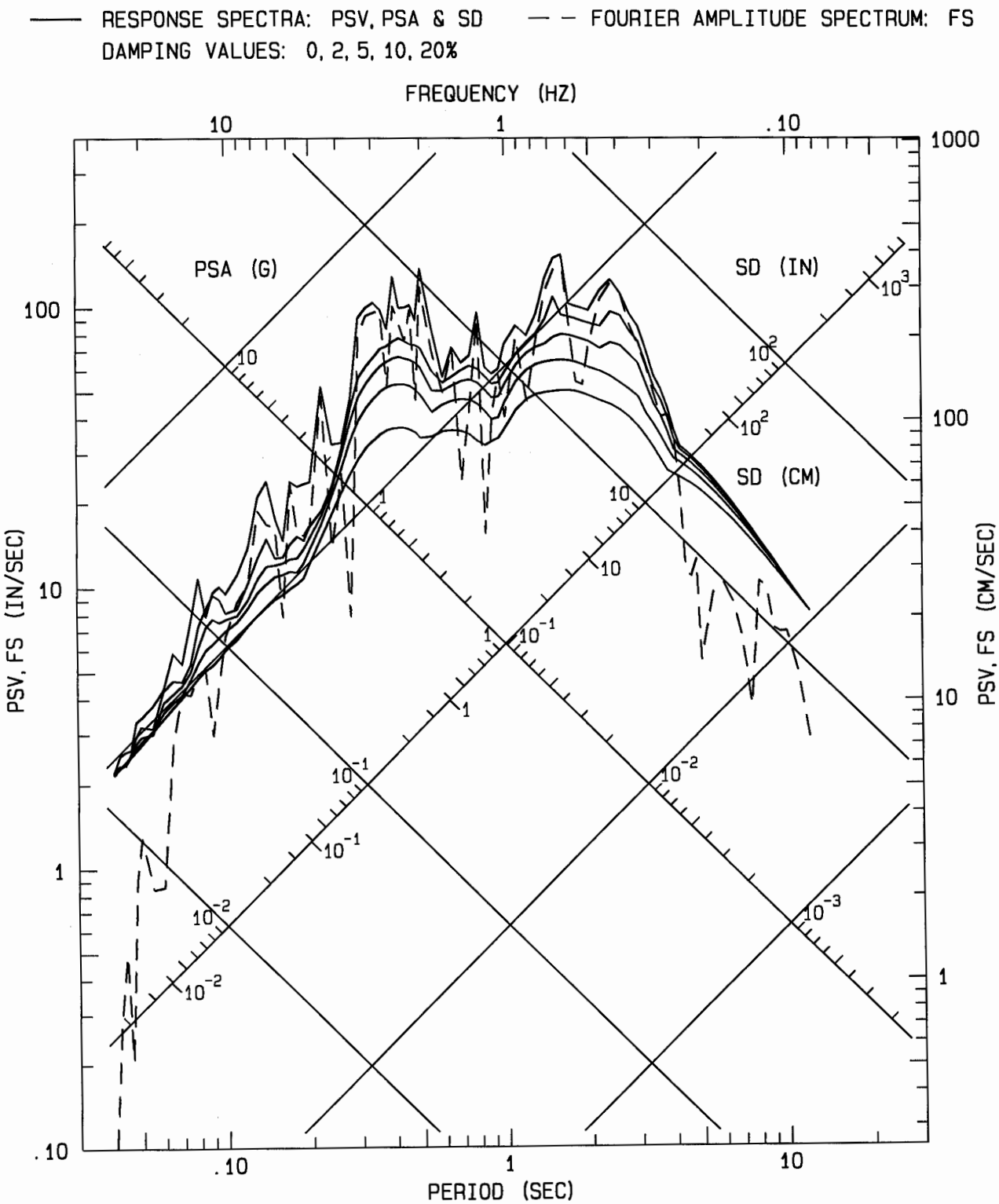
NORTHRIDGE EARTHQUAKE JANUARY 17, 1994 04:31 PST
SYLMAR - COUNTY HOSP. PARKING LOT
CHN 1: 90 DEG
ACCELEROGRAM BANDPASS-FILTERED WITH RAMPS AT .06-.12 TO 23.0-25.0 HZ.
24514-S5254-94017.03 020494.0929-QN94A514



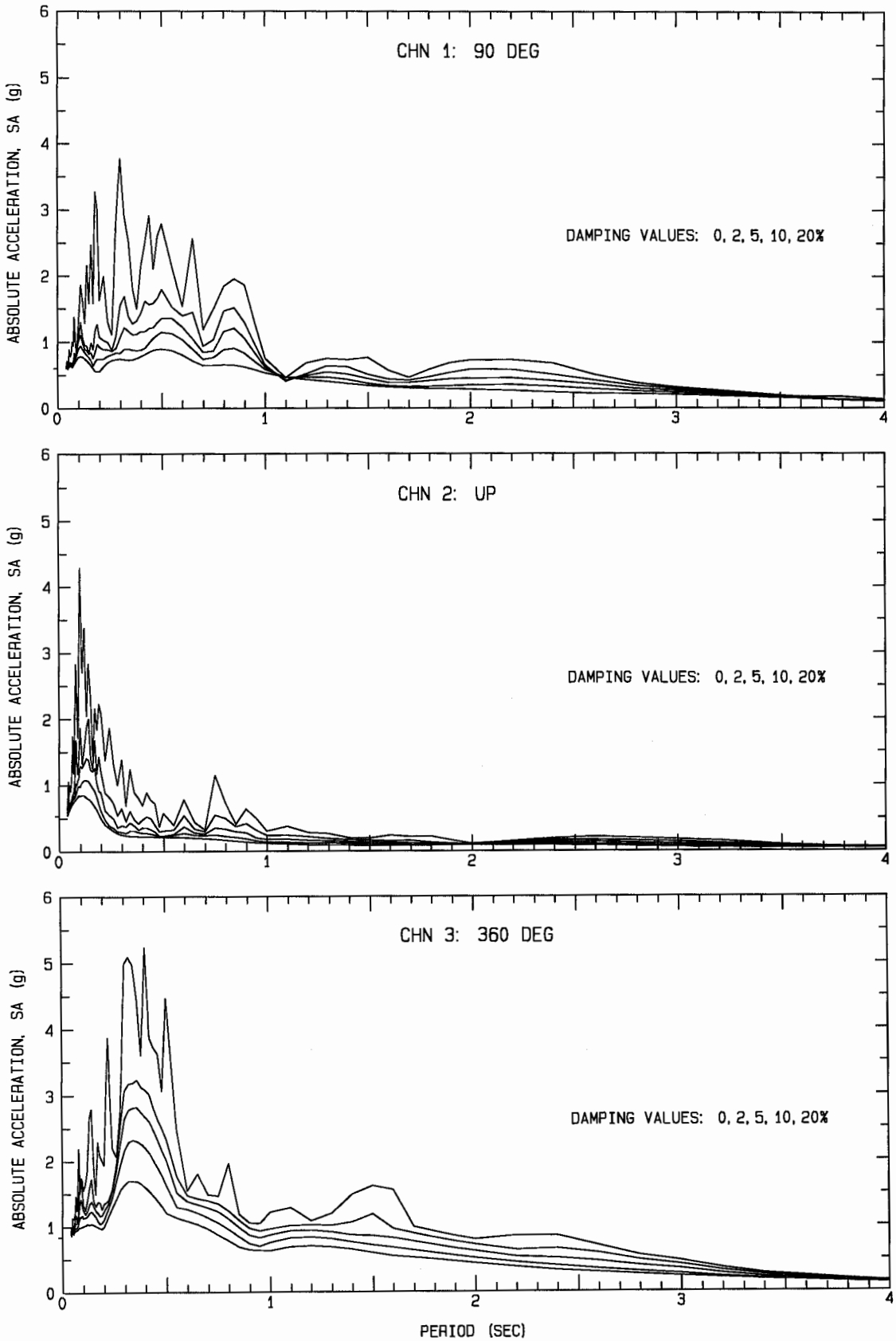
NORTHRIDGE EARTHQUAKE JANUARY 17, 1994 04:31 PST
SYLMAR - COUNTY HOSP. PARKING LOT
CHN 2: UP
ACCELEROGRAM BANDPASS-FILTERED WITH RAMPS AT .06-.12 TO 23.0-25.0 HZ.
24514-S5254-94017.03 020494.0929-QN94A514

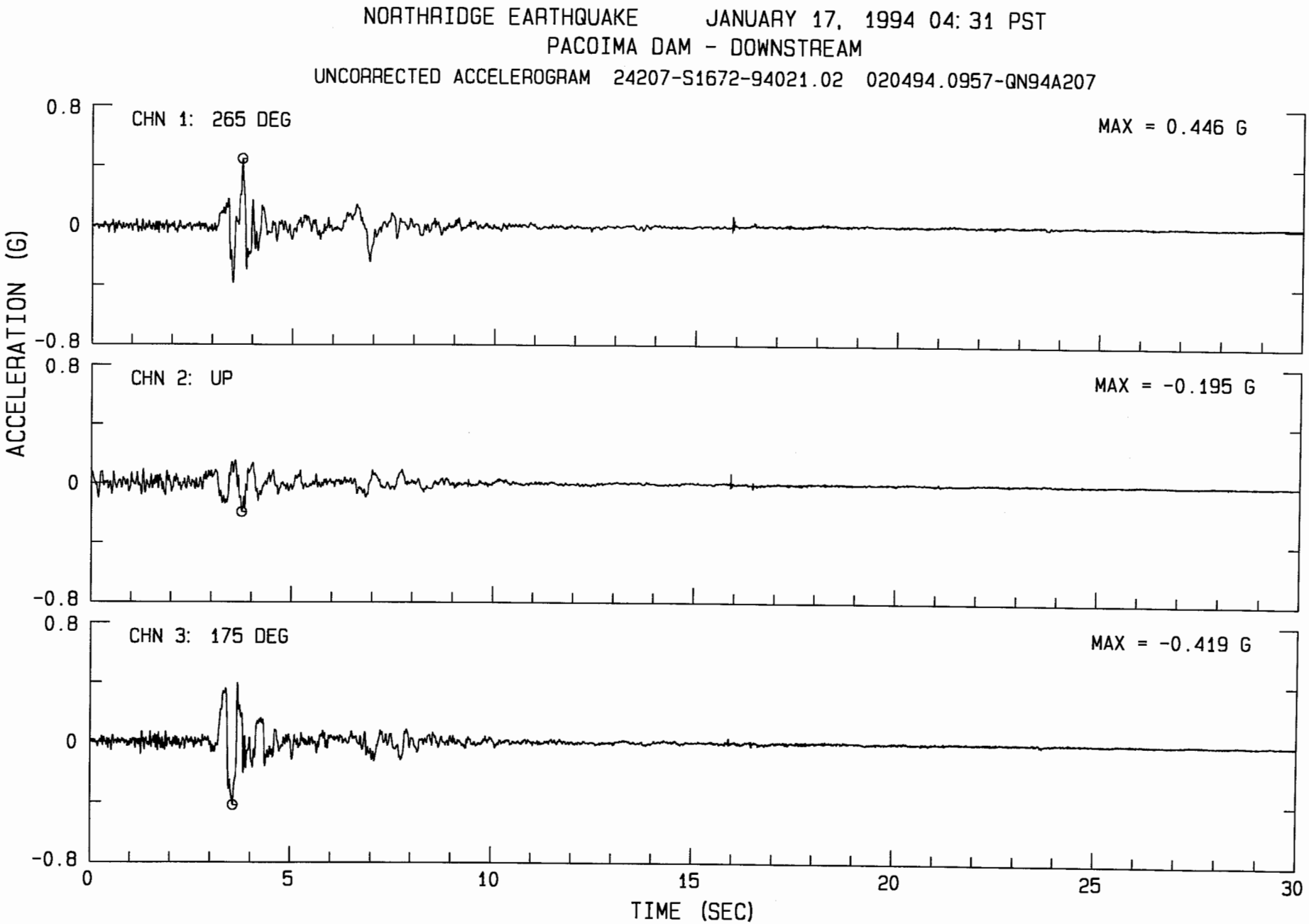


NORTHRIDGE EARTHQUAKE JANUARY 17, 1994 04:31 PST
SYLMAR - COUNTY HOSP. PARKING LOT
CHN 3: 360 DEG
ACCELEROGRAM BANDPASS-FILTERED WITH RAMPS AT .06-.12 TO 23.0-25.0 HZ.
24514-S5254-94017.03 020494.0929-QN94A514

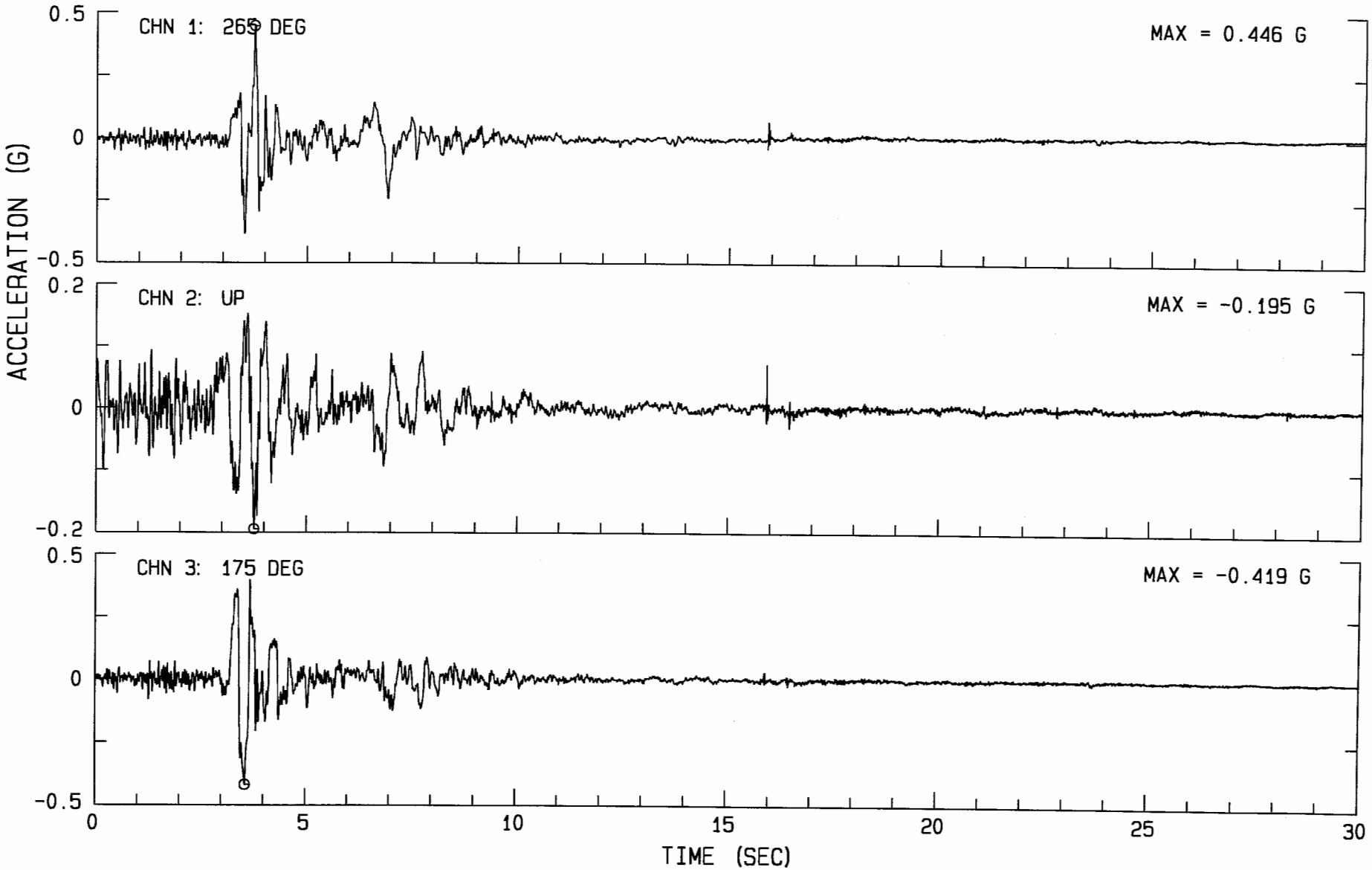


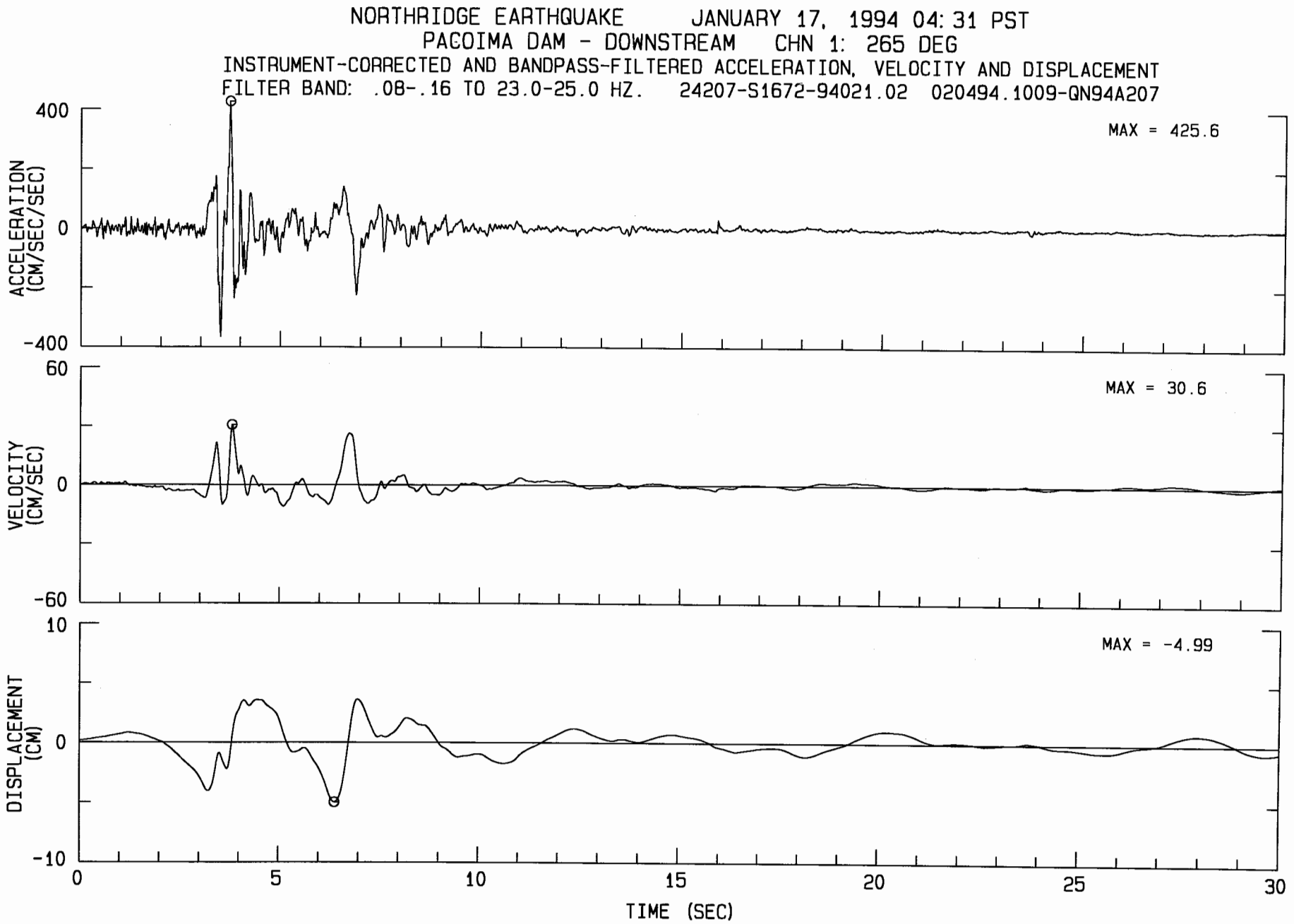
NORTHRIDGE EARTHQUAKE JANUARY 17, 1994 04:31 PST
SYLMAR - COUNTY HOSP. PARKING LOT
ACCELEROGRAM BANDPASS-FILTERED WITH RAMPS AT .06-.12 TO 23.0-25.0 HZ.
24514-S5254-94017.03 020494.0929-QN94A514



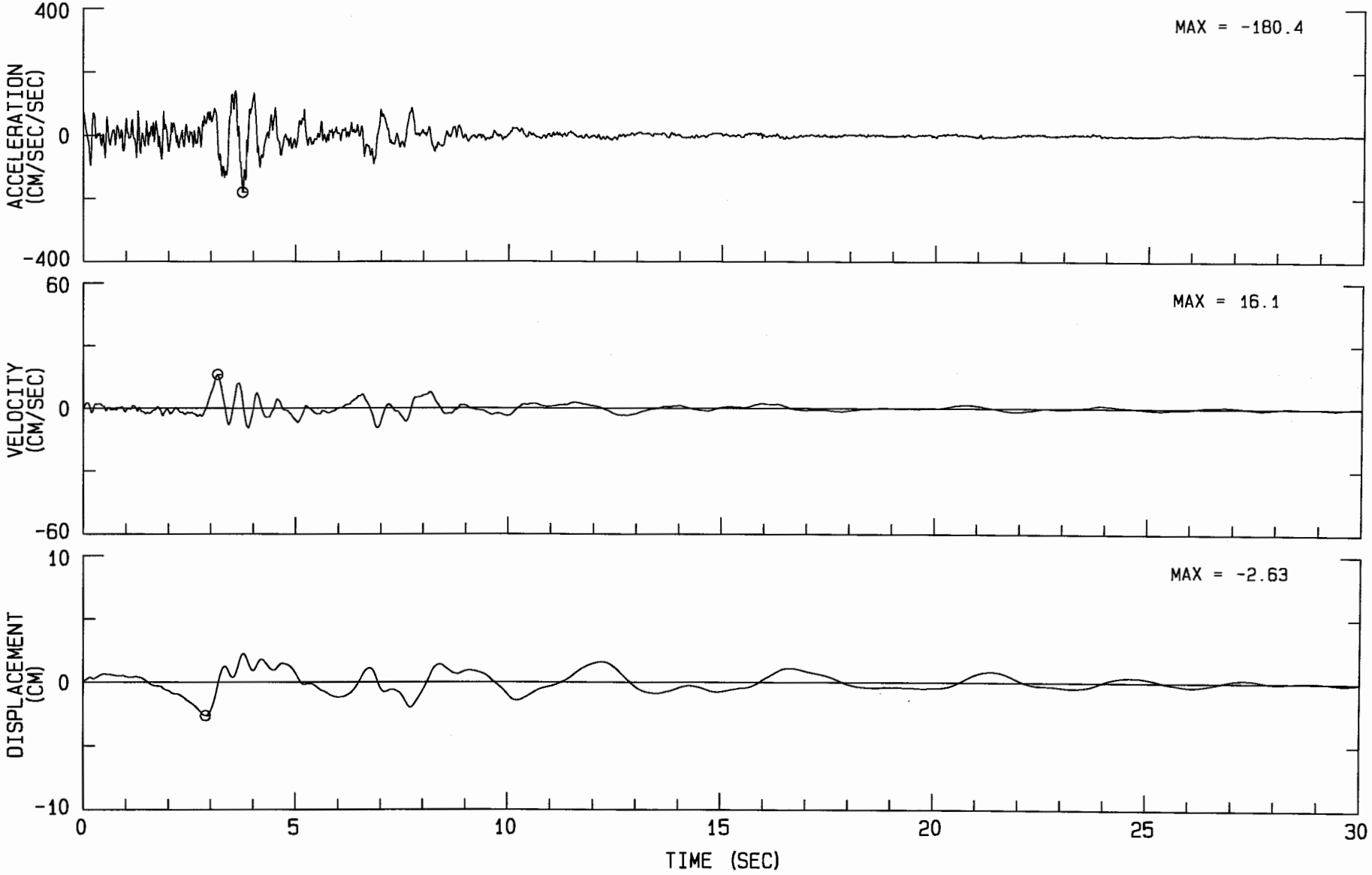

NORTHRIDGE EARTHQUAKE JANUARY 17, 1994 04:31 PST
PACOIMA DAM - DOWNSTREAM
UNCORRECTED ACCELEROGRAM 24207-S1672-94021.02 020494.0957-QN94A207
CHN 1: 265 DEG
MAX = 0.446 G
CHN 2: UP
MAX = -0.195 G
CHN 3: 175 DEG
MAX = -0.419 G
ACCELERATION (G)
0.8
0
-0.8
0
5
10
15
20
25
30
TIME (SEC)

NORTHRIDGE EARTHQUAKE JANUARY 17, 1994 04:31 PST
PACOIMA DAM - DOWNSTREAM
UNCORRECTED ACCELEROGRAM 24207-S1672-94021.02 020494.0957-QN94A207

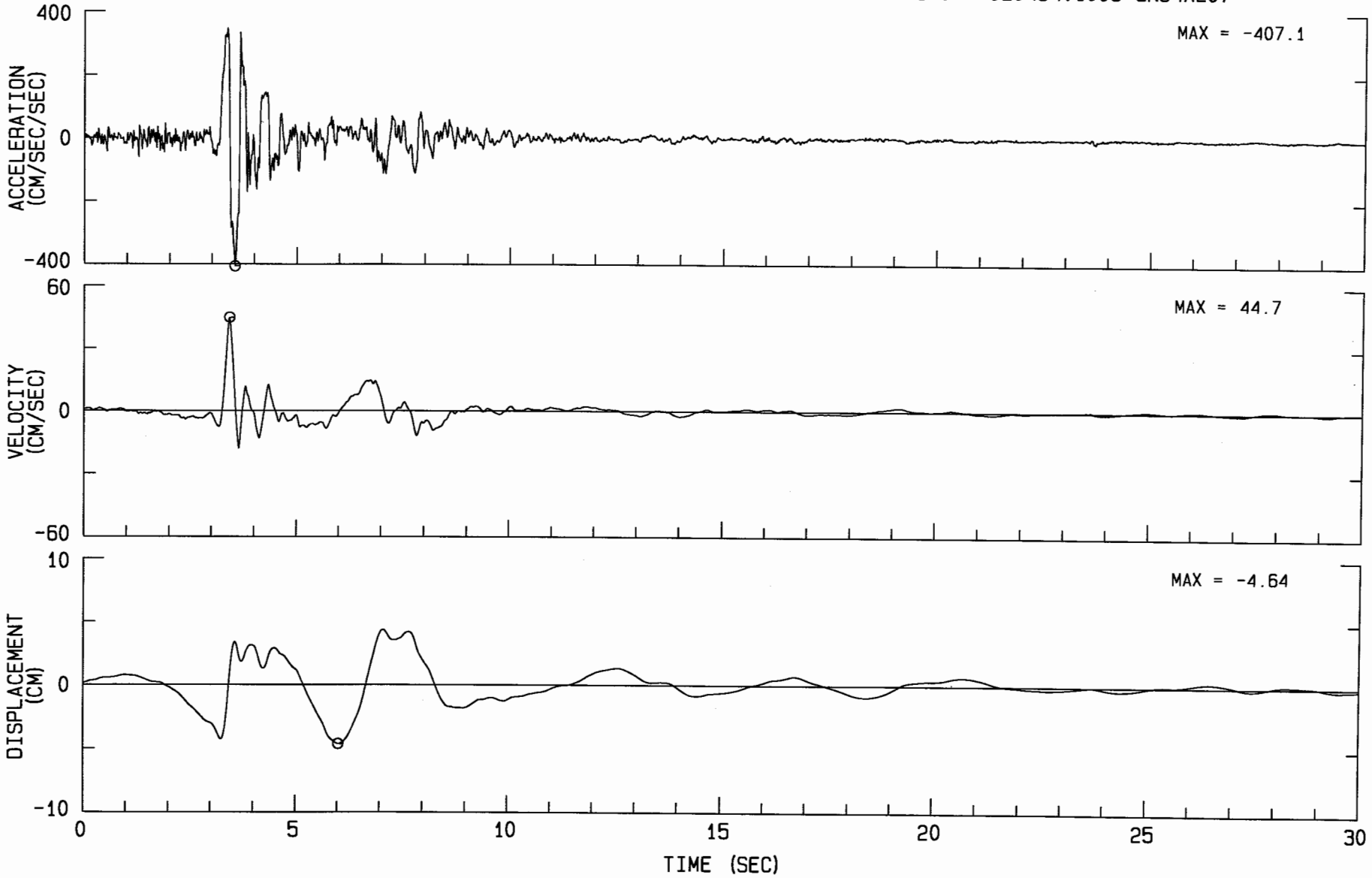



NORTHRIDGE EARTHQUAKE JANUARY 17, 1994 04:31 PST
PACOIMA DAM - DOWNSTREAM CHN 1: 265 DEG
INSTRUMENT-CORRECTED AND BANDPASS-FILTERED ACCELERATION, VELOCITY AND DISPLACEMENT
FILTER BAND: .08-.16 TO 23.0-25.0 HZ. 24207-S1672-94021.02 020494.1009-QN94A207
ACCELERATION (CM/SEC/SEC)
400
0
-400
MAX = 425.6
VELOCITY (CM/SEC)
60
0
-60
MAX = 30.6
DISPLACEMENT (CM)
10
0
-10
MAX = -4.99
0
5
10
15
20
25
30
TIME (SEC)

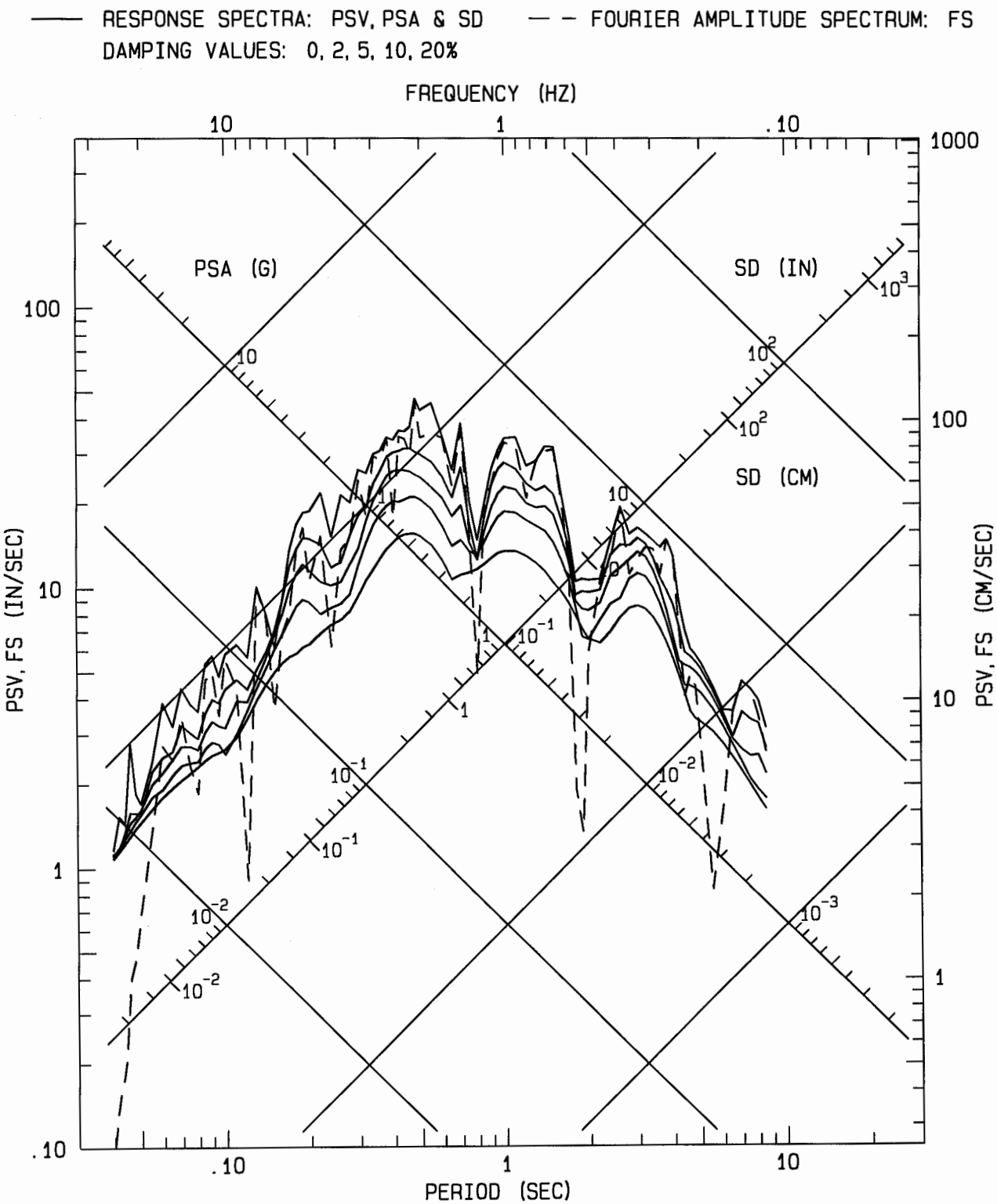
NORTHRIDGE EARTHQUAKE JANUARY 17, 1994 04:31 PST
PACOIMA DAM - DOWNSTREAM CHN 2: UP
INSTRUMENT-CORRECTED AND BANDPASS-FILTERED ACCELERATION, VELOCITY AND DISPLACEMENT
FILTER BAND: .08-.16 TO 23.0-25.0 HZ. 24207-S1672-94021.02 020494.1009-QN94A207



NORTHRIDGE EARTHQUAKE JANUARY 17, 1994 04:31 PST
PACOIMA DAM - DOWNSTREAM CHN 3: 175 DEG
INSTRUMENT-CORRECTED AND BANDPASS-FILTERED ACCELERATION, VELOCITY AND DISPLACEMENT
FILTER BAND: .08-.16 TO 23.0-25.0 HZ. 24207-S1672-94021.02 020494.1009-QN94A207



NORTHRIDGE EARTHQUAKE JANUARY 17, 1994 04:31 PST
PACOIMA DAM - DOWNSTREAM
CHN 1: 265 DEG
ACCELEROGRAM BANDPASS-FILTERED WITH RAMPS AT .08-.16 TO 23.0-25.0 HZ.
24207-S1672-94021.02 020494.1014-QN94A207



NORTHRIDGE EARTHQUAKE JANUARY 17, 1994 04:31 PST
PACOIMA DAM - DOWNSTREAM
CHN 2: UP
ACCELEROGRAM BANDPASS-FILTERED WITH RAMPS AT .08-.16 TO 23.0-25.0 HZ.
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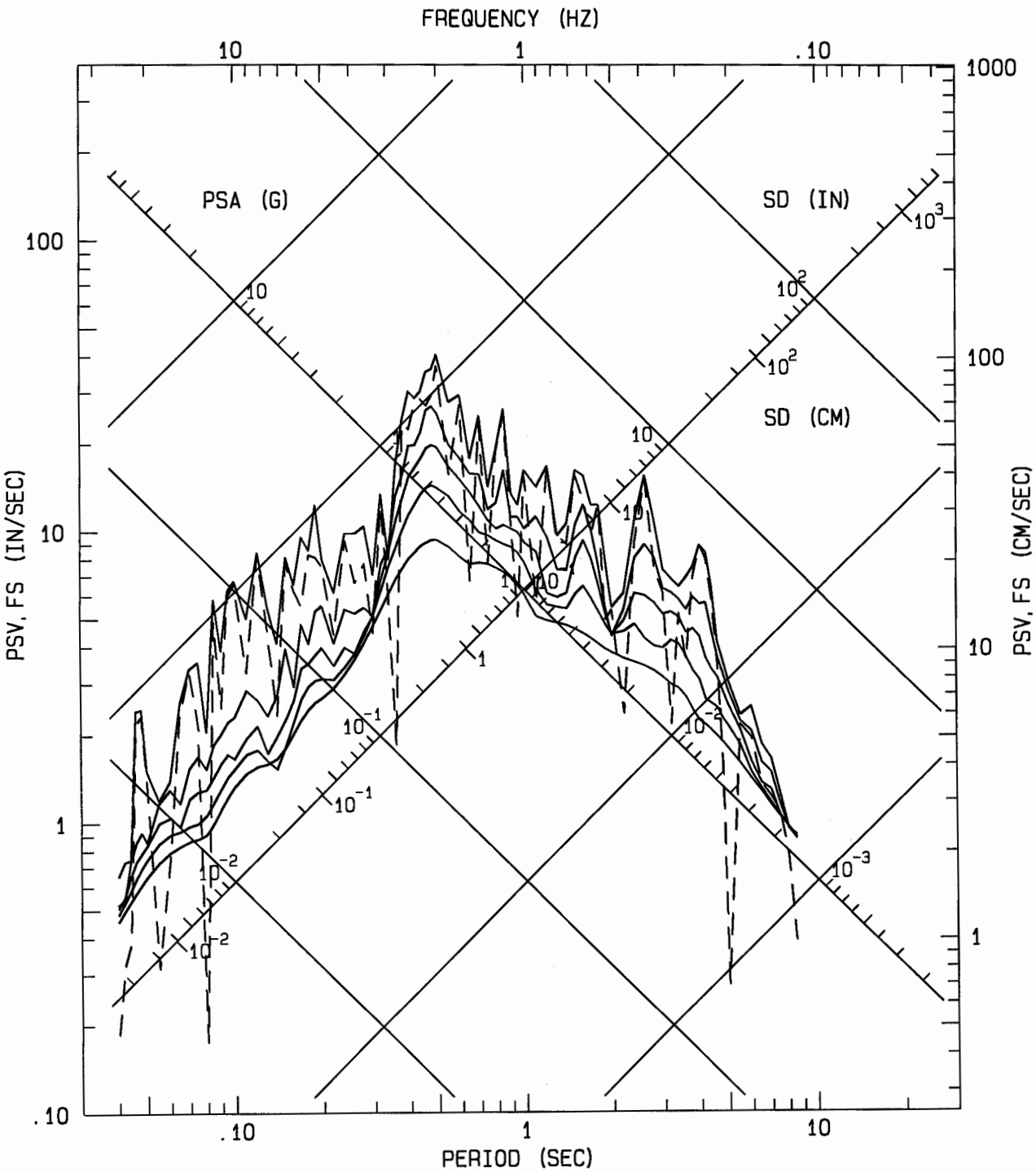

NORTHRIDGE EARTHQUAKE JANUARY 17, 1994 04:31 PST
PACOIMA DAM - DOWNSTREAM
CHN 3: 175 DEG
ACCELEROGRAM BANDPASS-FILTERED WITH RAMPS AT .08-.16 TO 23.0-25.0 HZ.
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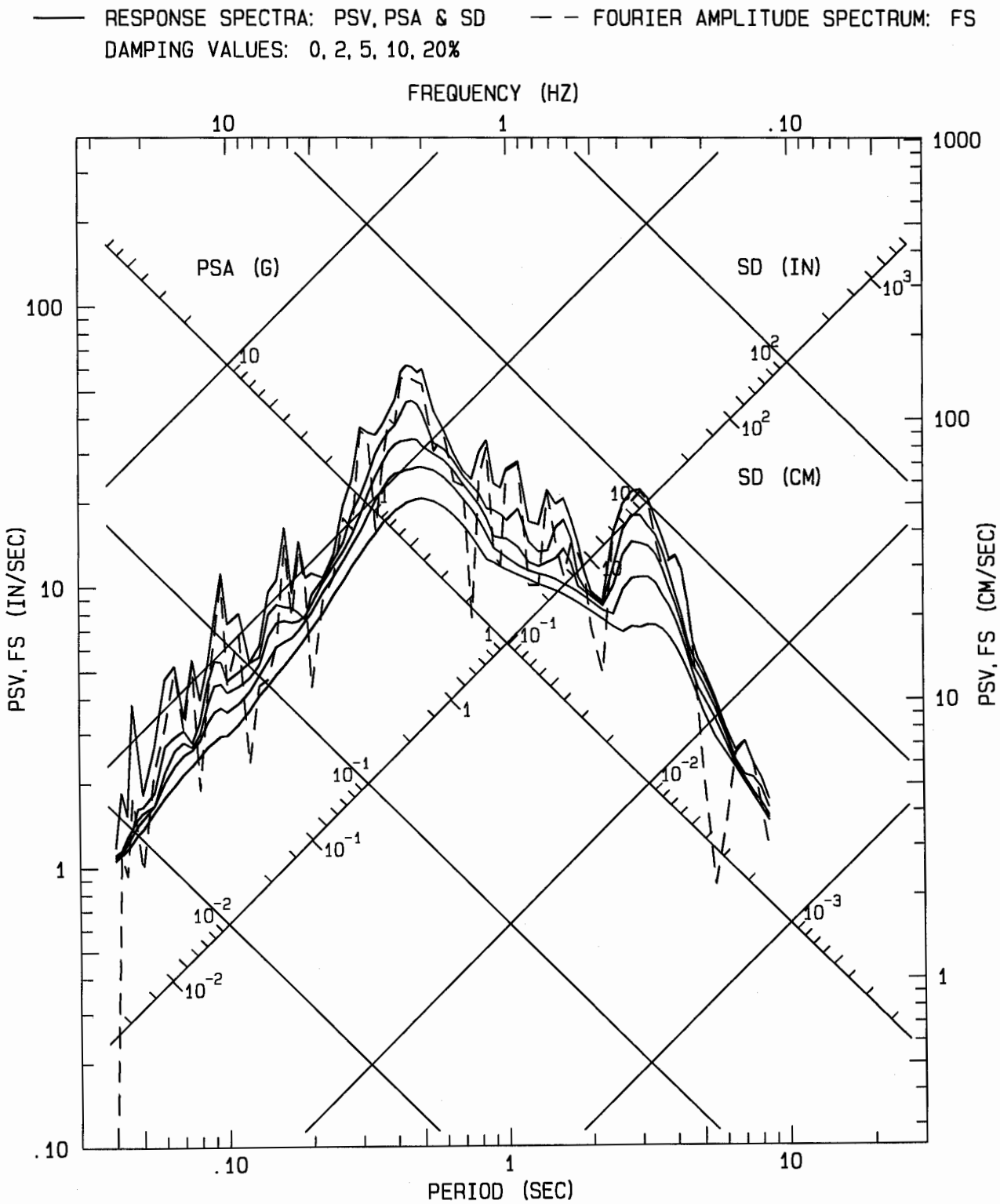

NORTHRIDGE EARTHQUAKE JANUARY 17, 1994 04:31 PST
PACOIMA DAM - DOWNSTREAM
ACCELEROGRAM BANDPASS-FILTERED WITH RAMPS AT .08-.16 TO 23.0-25.0 HZ.
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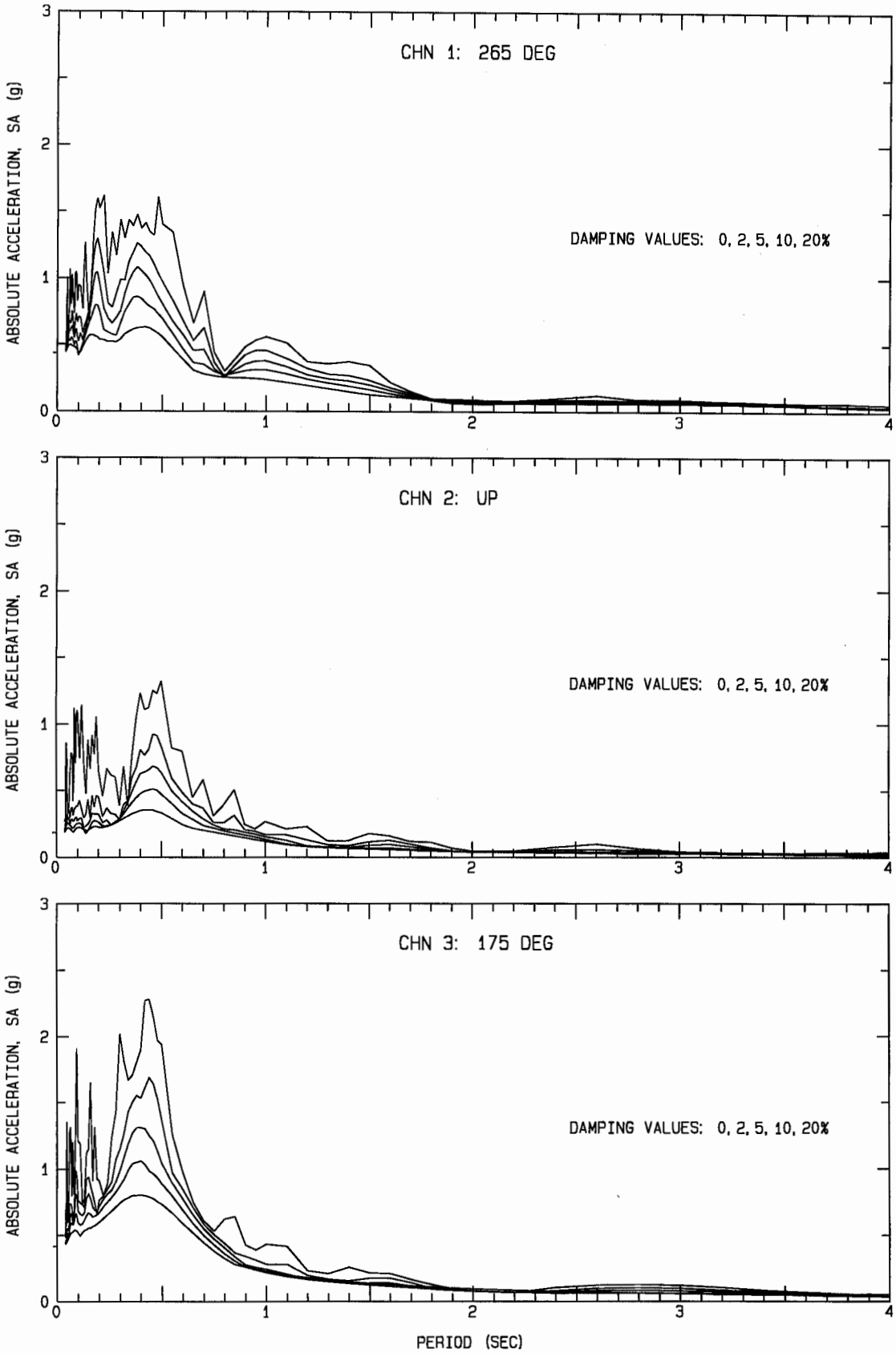
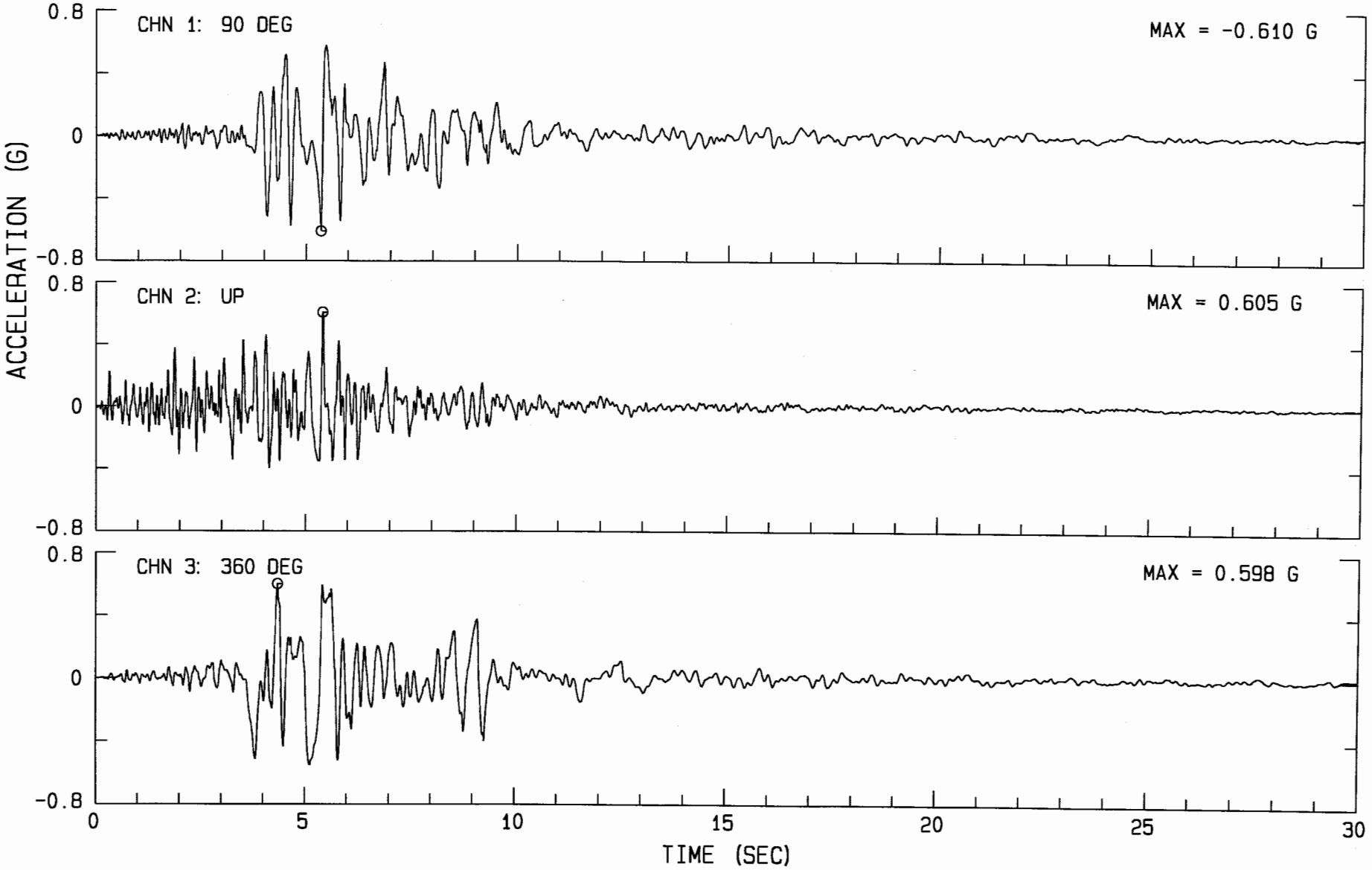


NORTHRIDGE EARTHQUAKE JANUARY 17, 1994 04:31 PST
NEWHALL - LA COUNTY FIRE STATION
UNCORRECTED ACCELEROGRAM 24279-S2499-94021.02 020194.1158-QN94A279



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NEWHALL - LA COUNTY FIRE STATION
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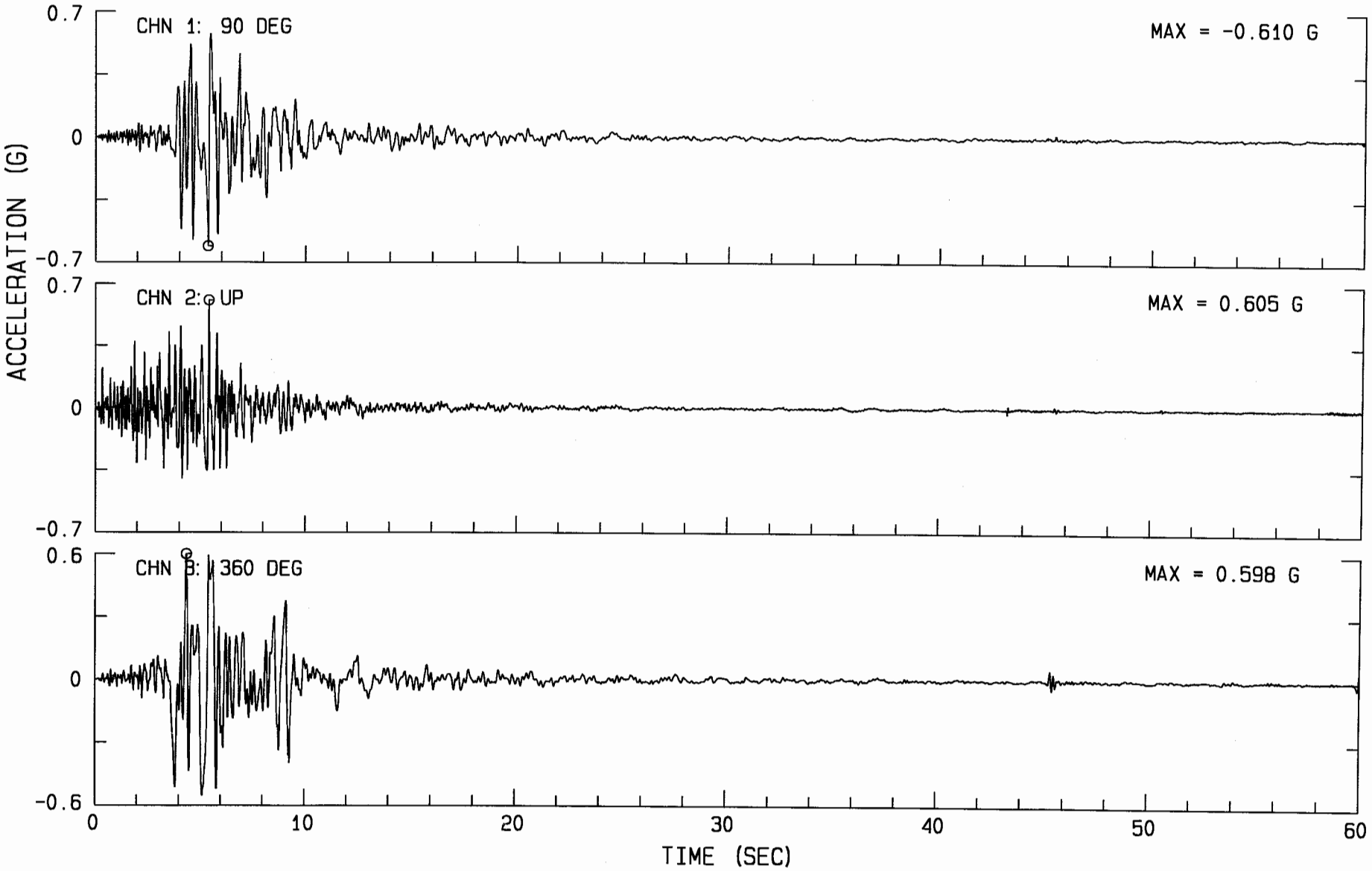
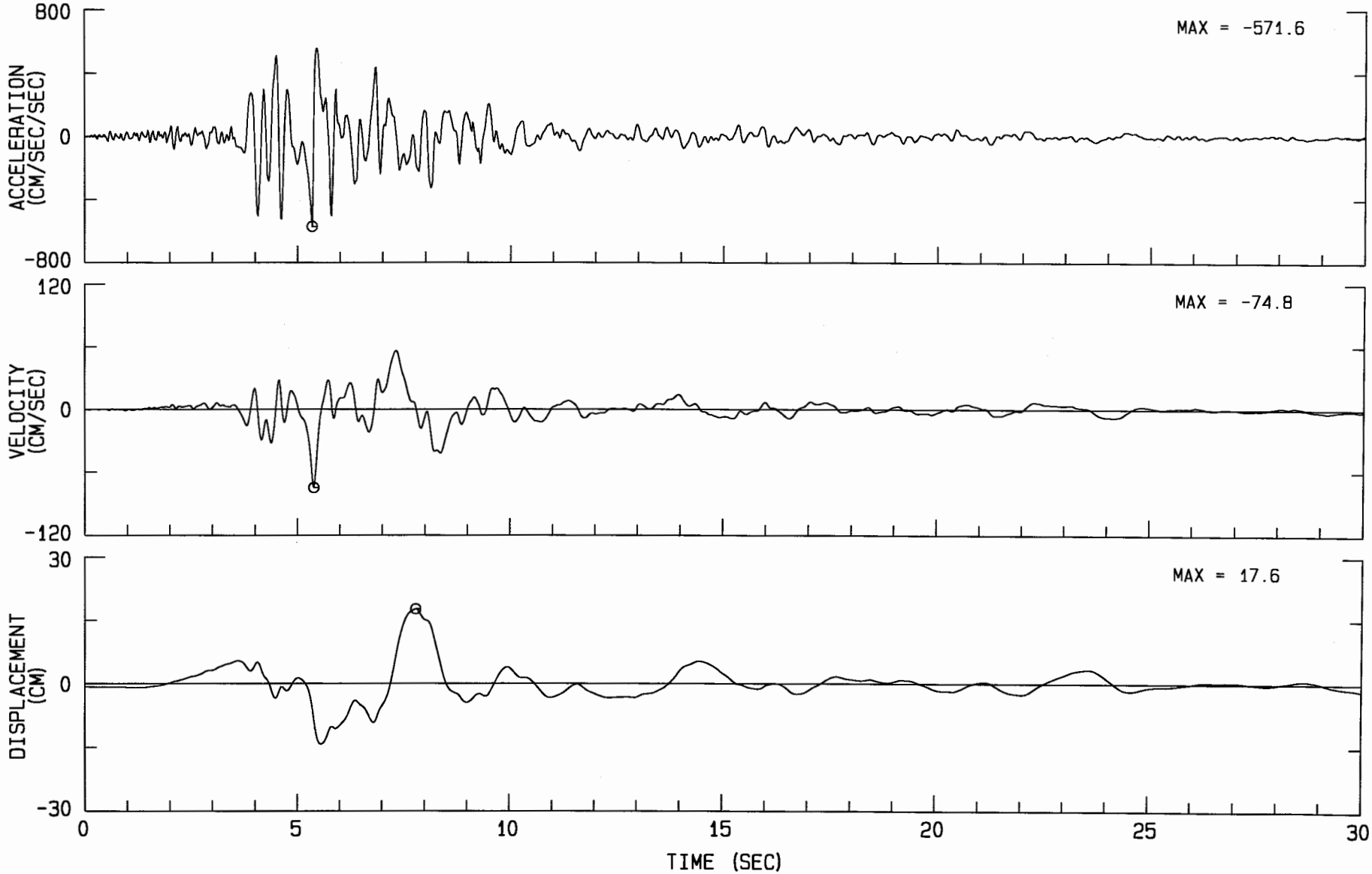
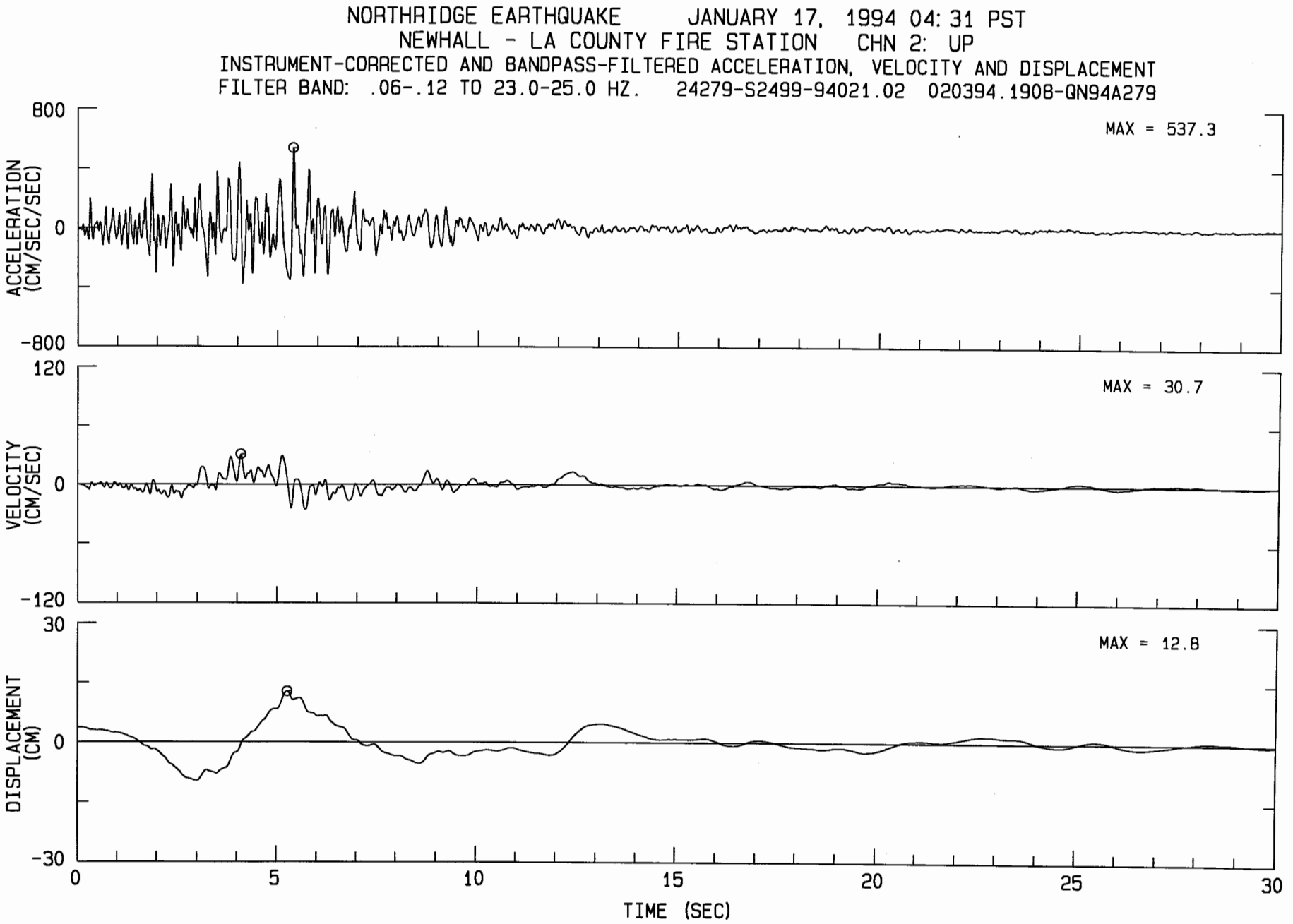
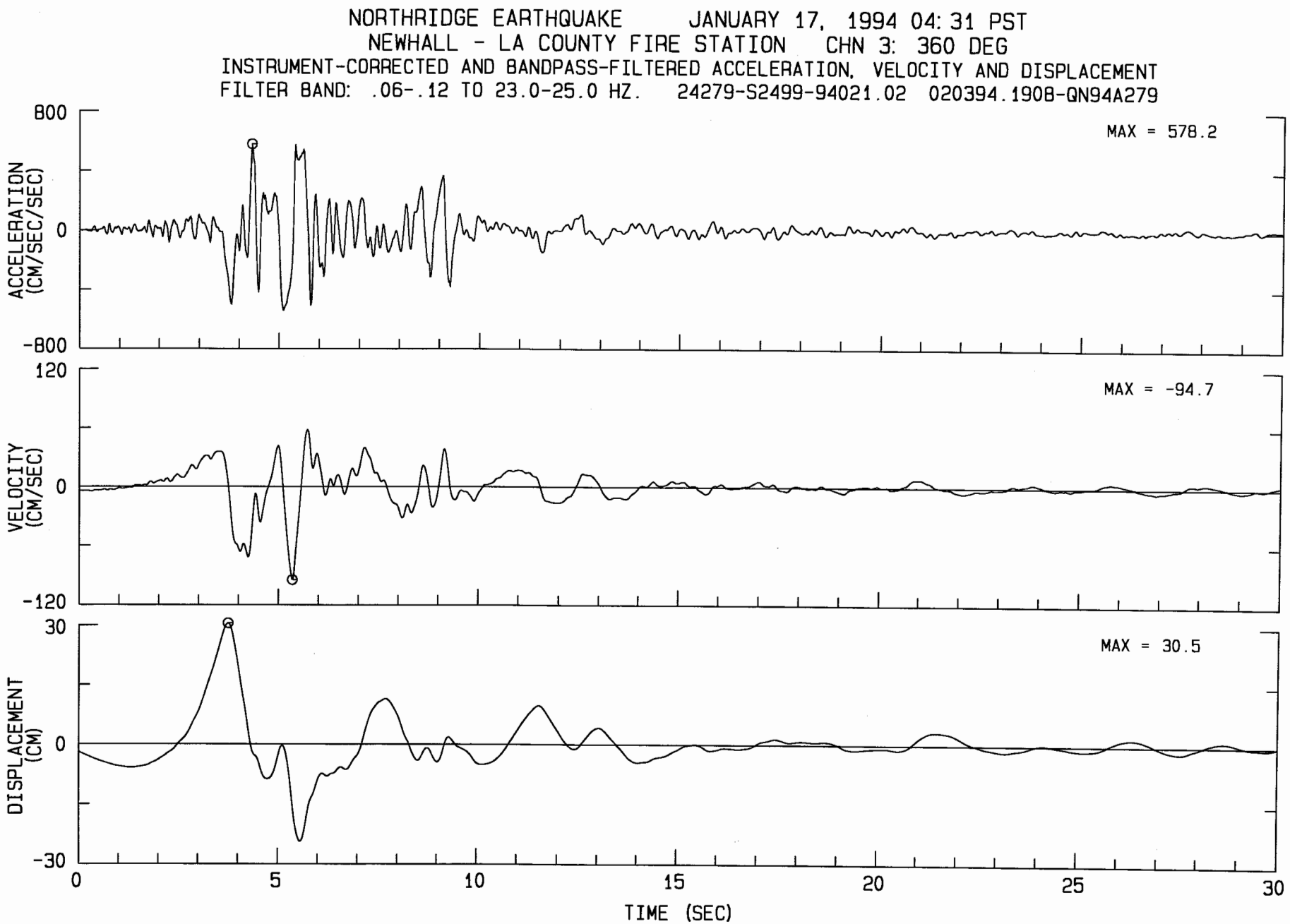


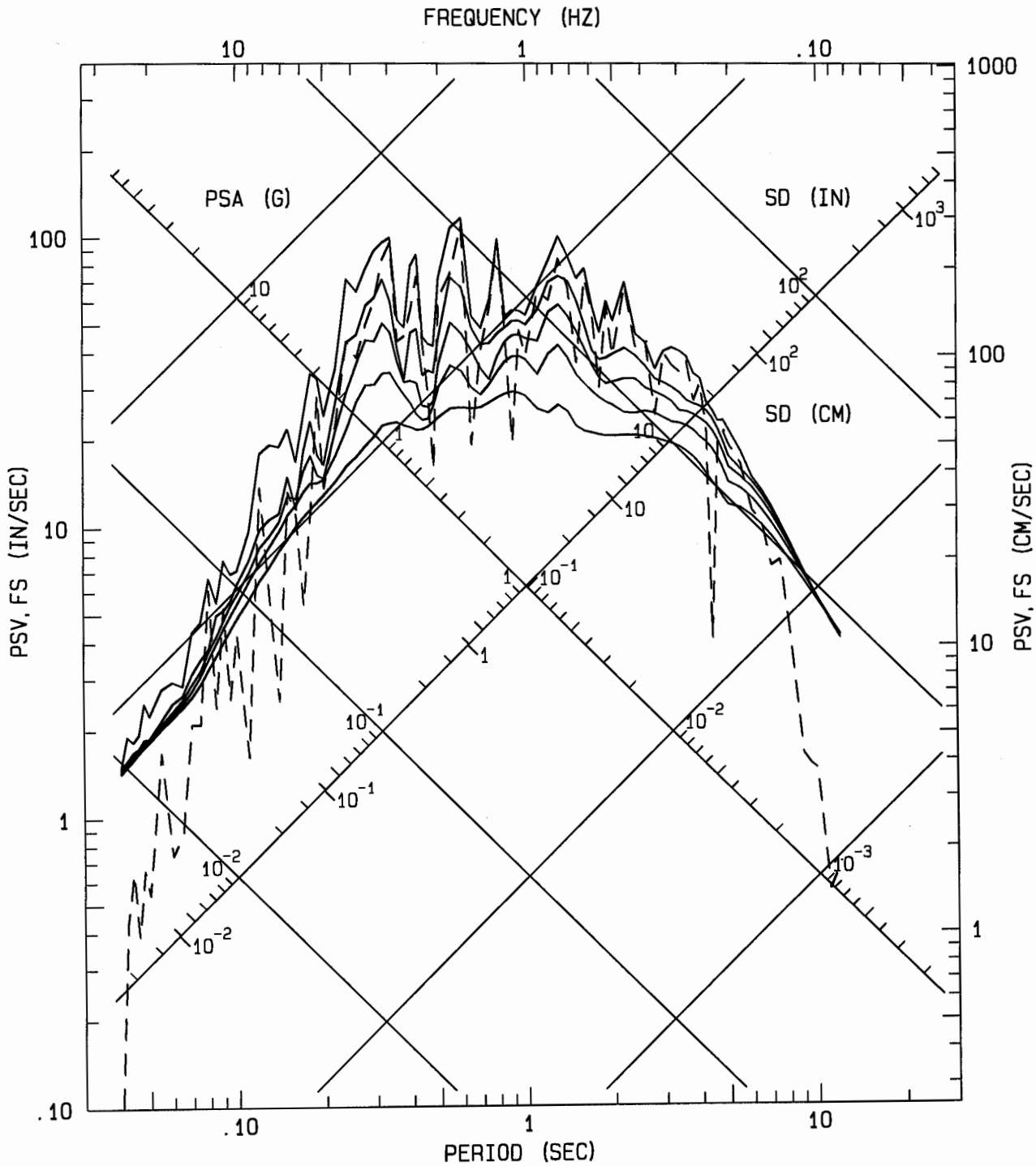
NORTHRIDGE EARTHQUAKE JANUARY 17, 1994 04:31 PST
NEWHALL - LA COUNTY FIRE STATION CHN 1: 90 DEG
INSTRUMENT-CORRECTED AND BANDPASS-FILTERED ACCELERATION, VELOCITY AND DISPLACEMENT
FILTER BAND: .06-.12 TO 23.0-25.0 HZ. 24279-S2499-94021.02 020394.1908-QN94A279




NORTHRIDGE EARTHQUAKE JANUARY 17, 1994 04:31 PST
NEWHALL - LA COUNTY FIRE STATION CHN 2: UP
INSTRUMENT-CORRECTED AND BANDPASS-FILTERED ACCELERATION, VELOCITY AND DISPLACEMENT
FILTER BAND: .06-.12 TO 23.0-25.0 HZ. 24279-S2499-94021.02 020394.1908-QN94A279
ACCELERATION (CM/SEC/SEC)
800
0
-800
MAX = 537.3
VELOCITY (CM/SEC)
120
0
-120
MAX = 30.7
DISPLACEMENT (CM)
30
0
-30
MAX = 12.8
0
5
10
15
20
25
30
TIME (SEC)


NORTHRIDGE EARTHQUAKE JANUARY 17, 1994 04:31 PST
NEWHALL - LA COUNTY FIRE STATION CHN 3: 360 DEG
INSTRUMENT-CORRECTED AND BANDPASS-FILTERED ACCELERATION, VELOCITY AND DISPLACEMENT
FILTER BAND: .06-.12 TO 23.0-25.0 HZ. 24279-S2499-94021.02 020394.1908-QN94A279
ACCELERATION (CM/SEC/SEC)
800
0
-800
MAX = 578.2
VELOCITY (CM/SEC)
120
0
-120
MAX = -94.7
DISPLACEMENT (CM)
30
0
-30
MAX = 30.5
0
5
10
15
20
25
30
TIME (SEC)

NORTHRIDGE EARTHQUAKE JANUARY 17, 1994 04:31 PST
NEWHALL - LA COUNTY FIRE STATION
CHN 1: 90 DEG
ACCELEROGRAM BANDPASS-FILTERED WITH RAMPS AT .06-.12 TO 23.0-25.0 HZ.
24279-S2499-94021.02 020494.0947-QN94A279



NORTHRIDGE EARTHQUAKE JANUARY 17, 1994 04:31 PST
NEWHALL - LA COUNTY FIRE STATION
CHN 2: UP
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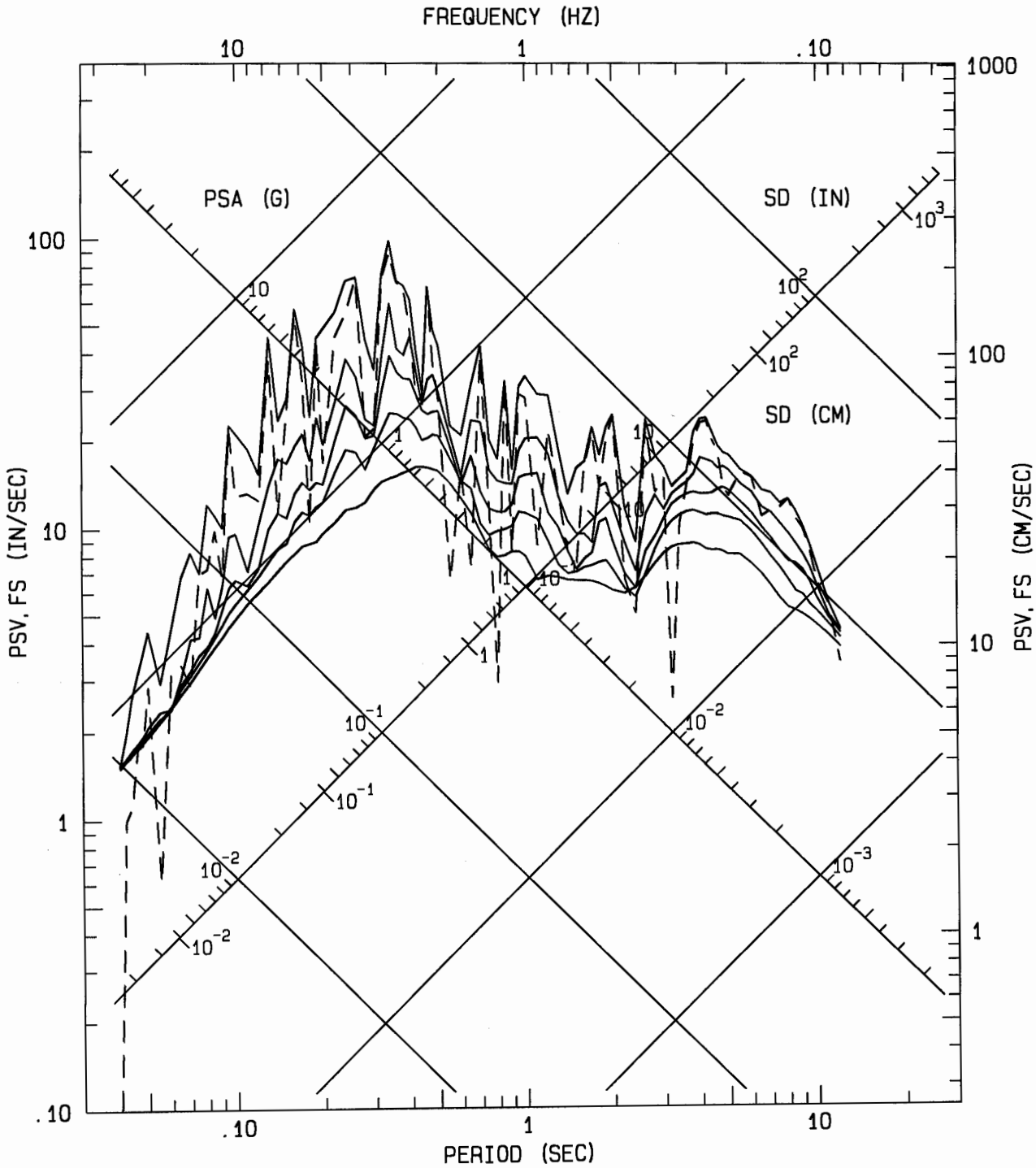
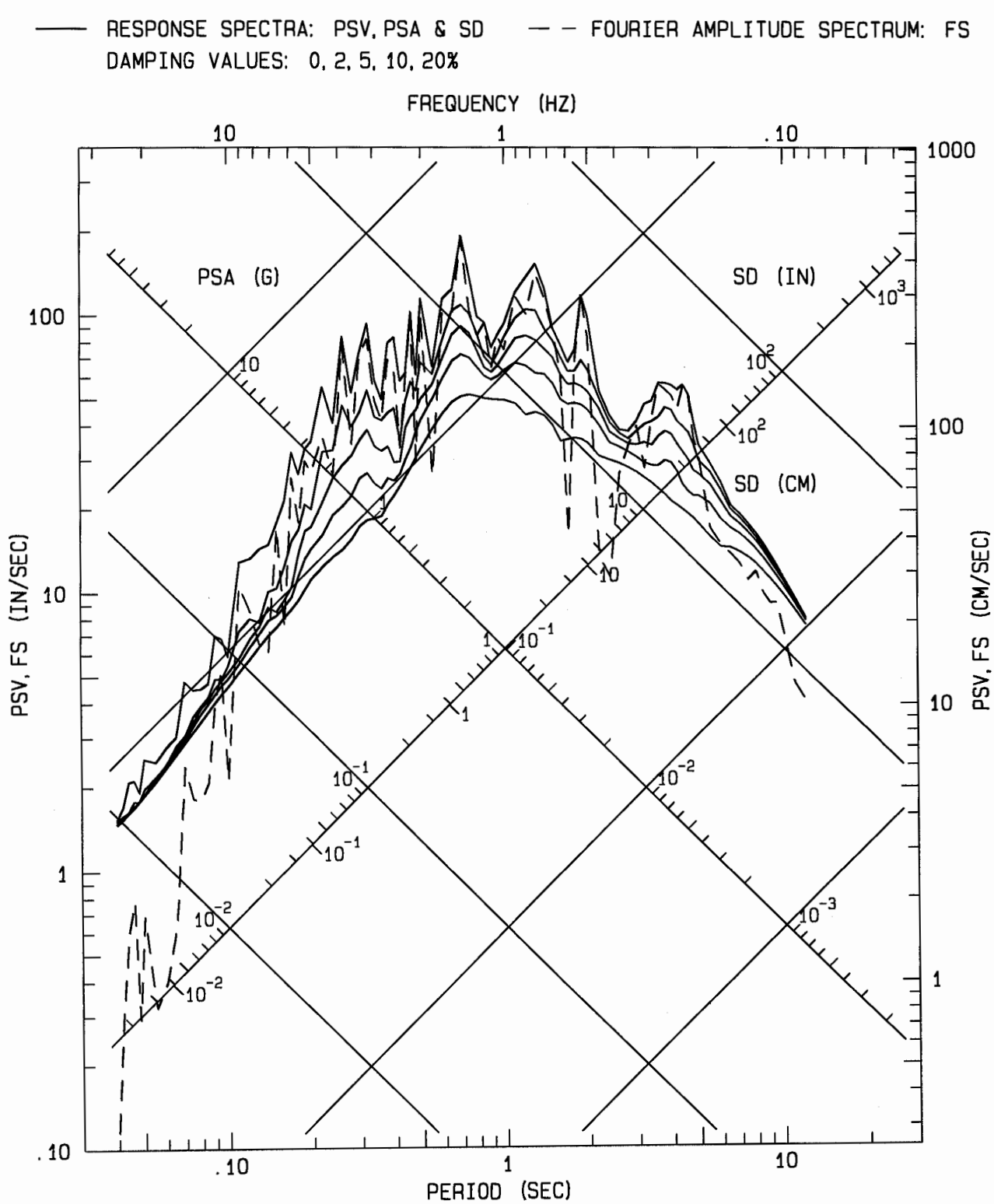
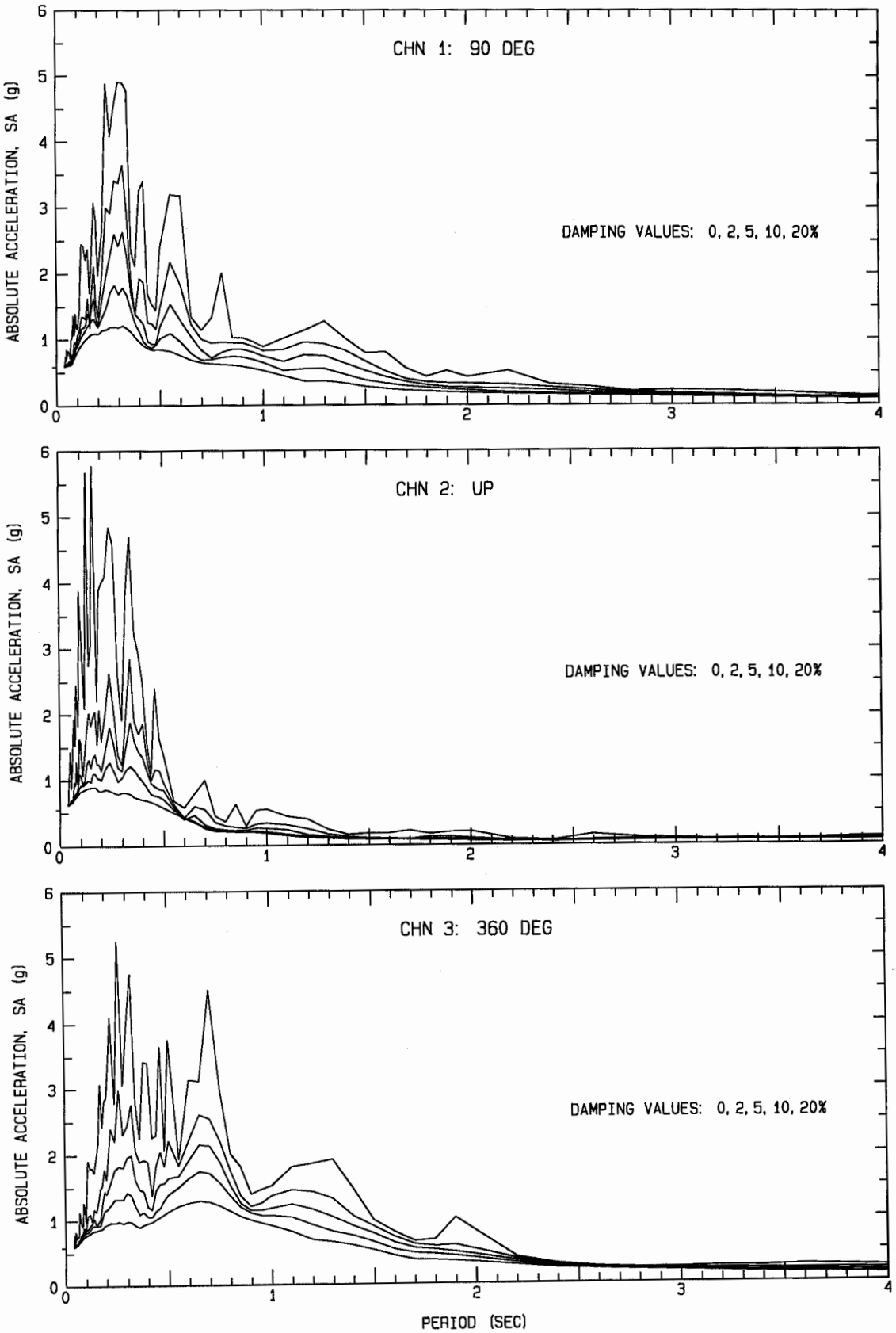
24279-S2499-94021.02 020494.0947-QN94A279



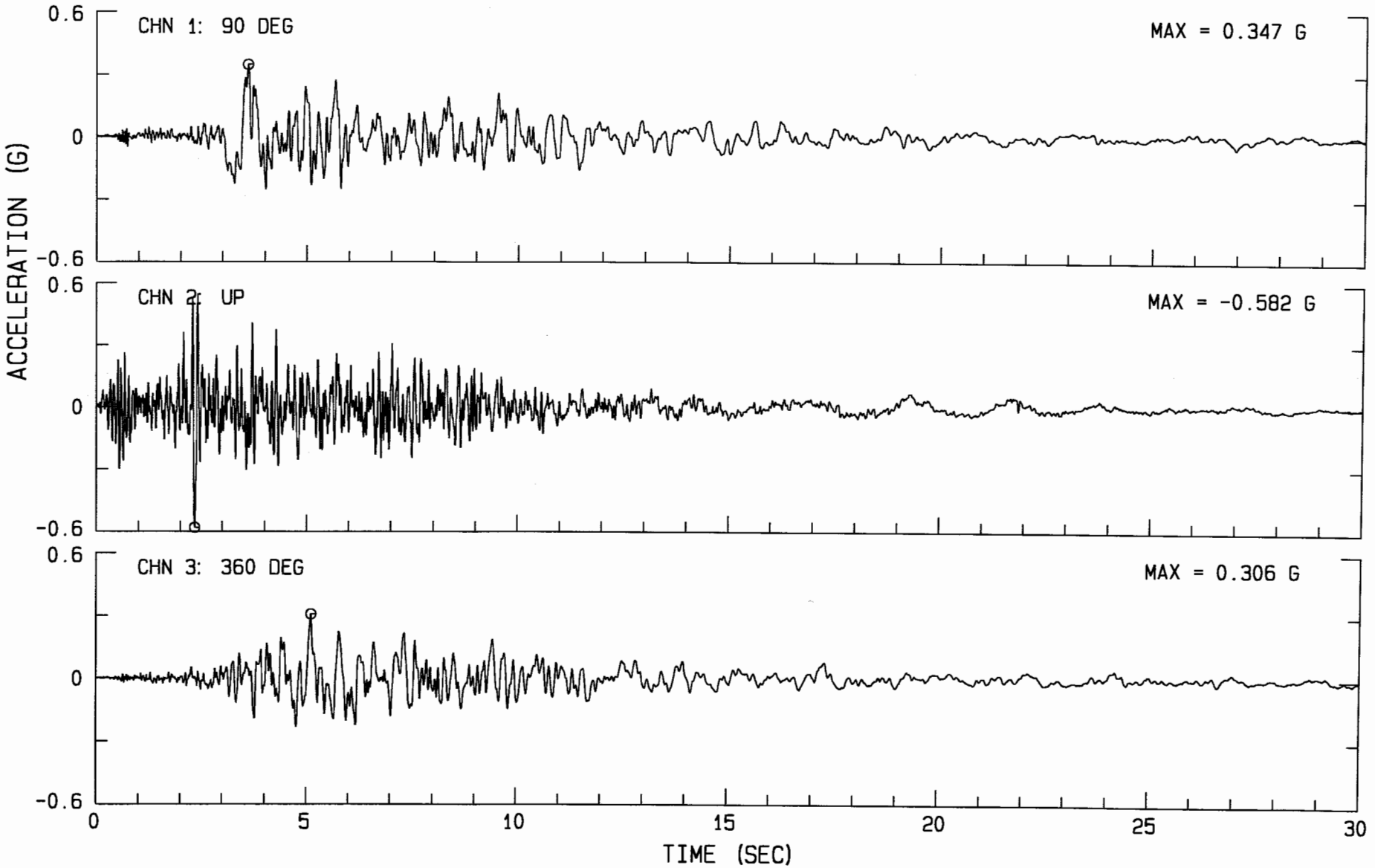
NORTHRIDGE EARTHQUAKE JANUARY 17, 1994 04:31 PST
NEWHALL - LA COUNTY FIRE STATION
CHN 3: 360 DEG
ACCELEROGRAM BANDPASS-FILTERED WITH RAMPS AT .06-.12 TO 23.0-25.0 HZ.
24279-S2499-94021.02 020494.0947-QN94A279



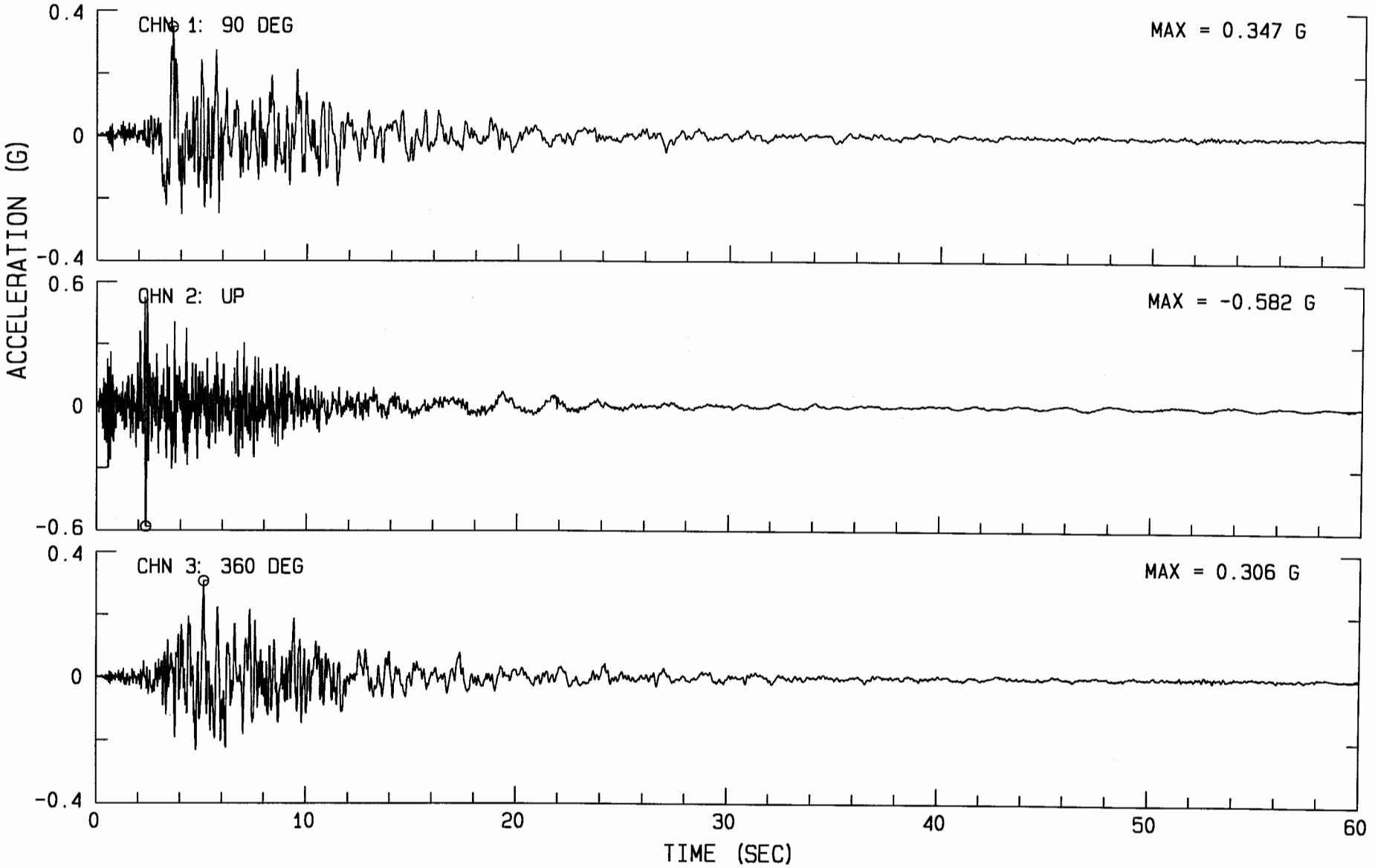
NORTHRIDGE EARTHQUAKE JANUARY 17, 1994 04:31 PST
NEWHALL - LA COUNTY FIRE STATION
ACCELEROGRAM BANDPASS-FILTERED WITH RAMPS AT .06-.12 TO 23.0-25.0 HZ.
24279-S2499-94021.02 020494.0947-QN94A279



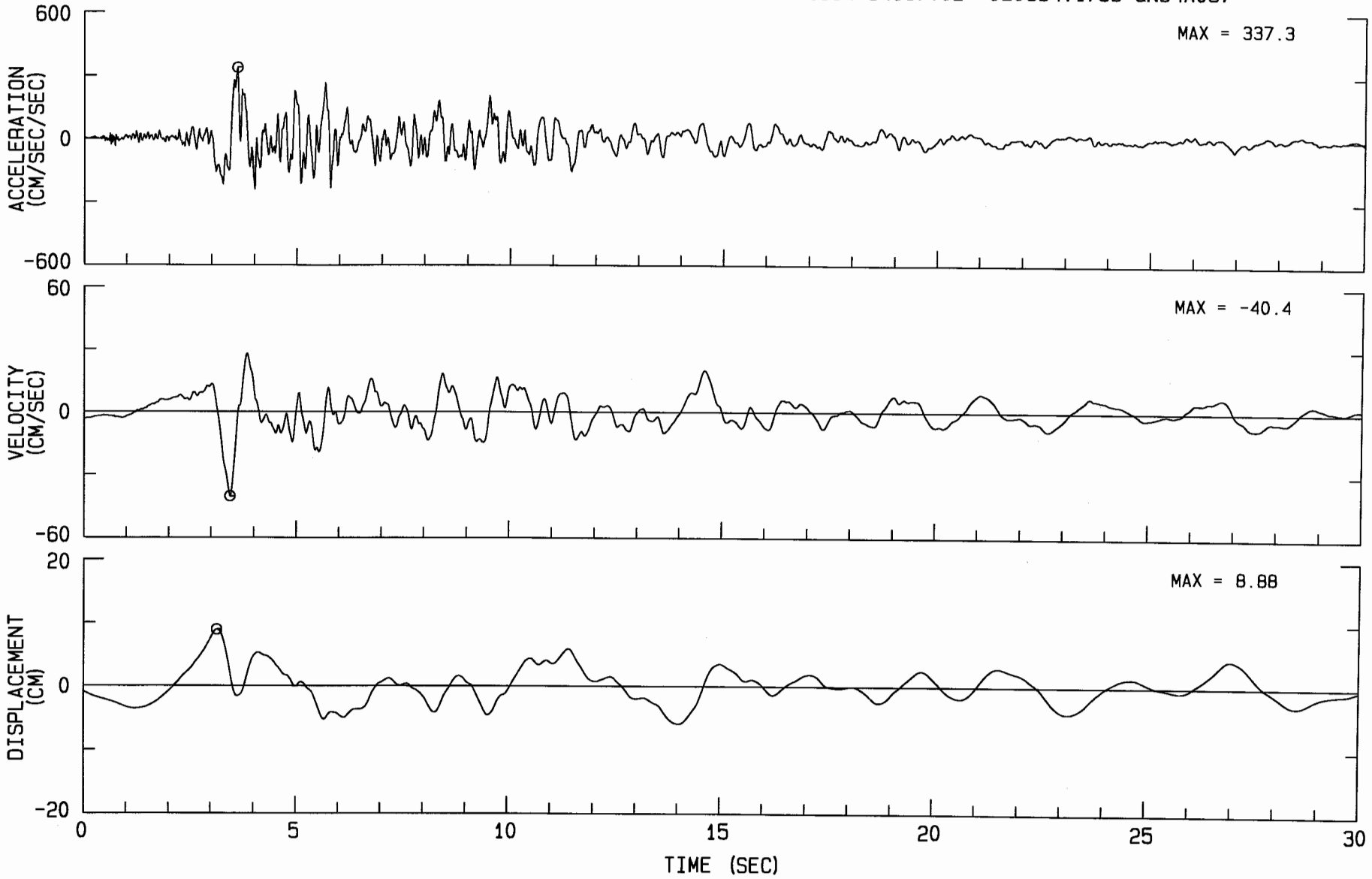
NORTHRIDGE EARTHQUAKE JANUARY 17, 1994 04:31 PST
ARLETA - NORDHOFF AVE FIRE STATION
UNCORRECTED ACCELEROGRAM 24087-S1594-94017.02 012694.1208-QN94A087

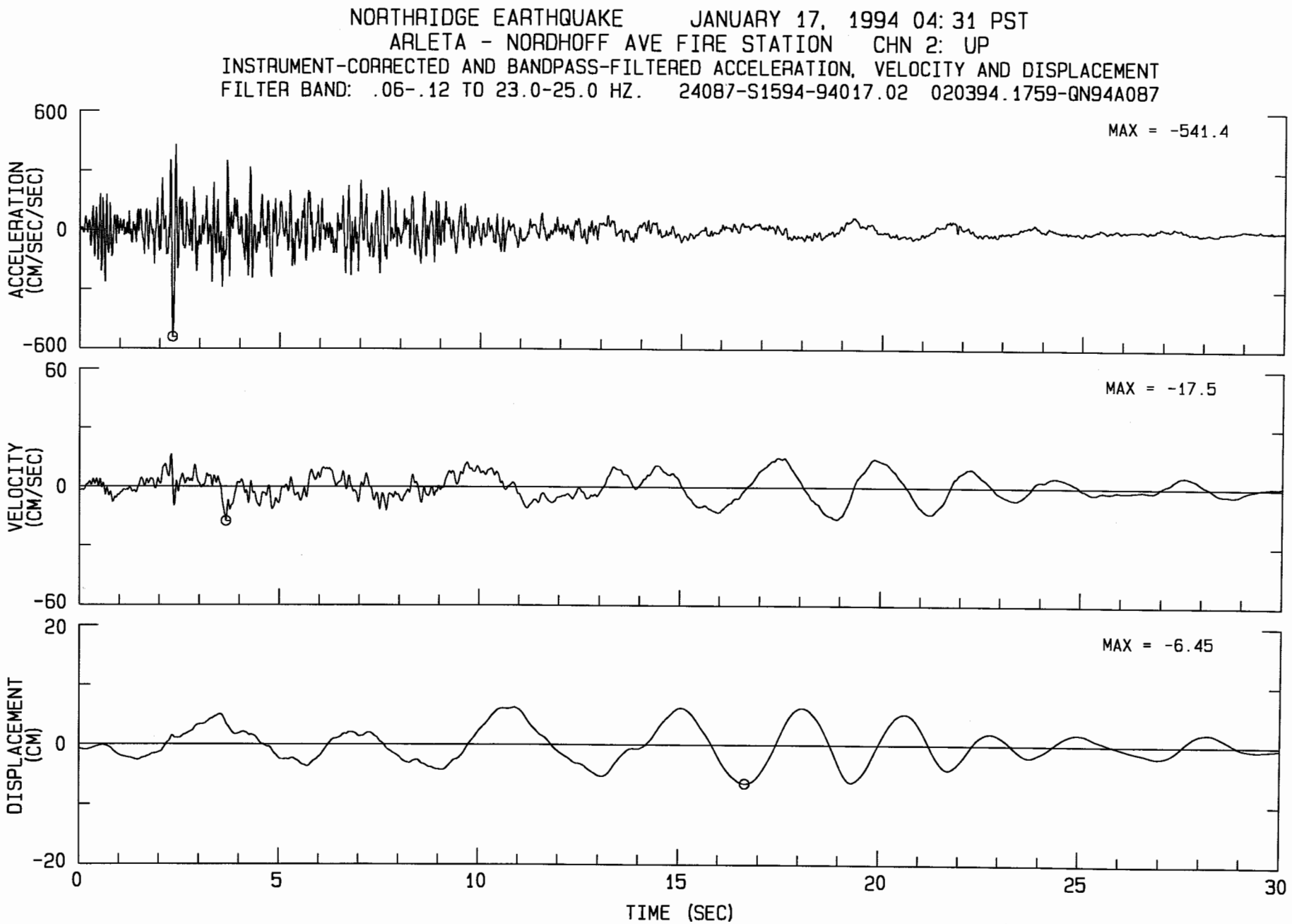


NORTHRIDGE EARTHQUAKE JANUARY 17, 1994 04:31 PST
ARLETA - NORDHOFF AVE FIRE STATION
UNCORRECTED ACCELEROGRAM 24087-S1594-94017.02 012694.1208-QN94A087

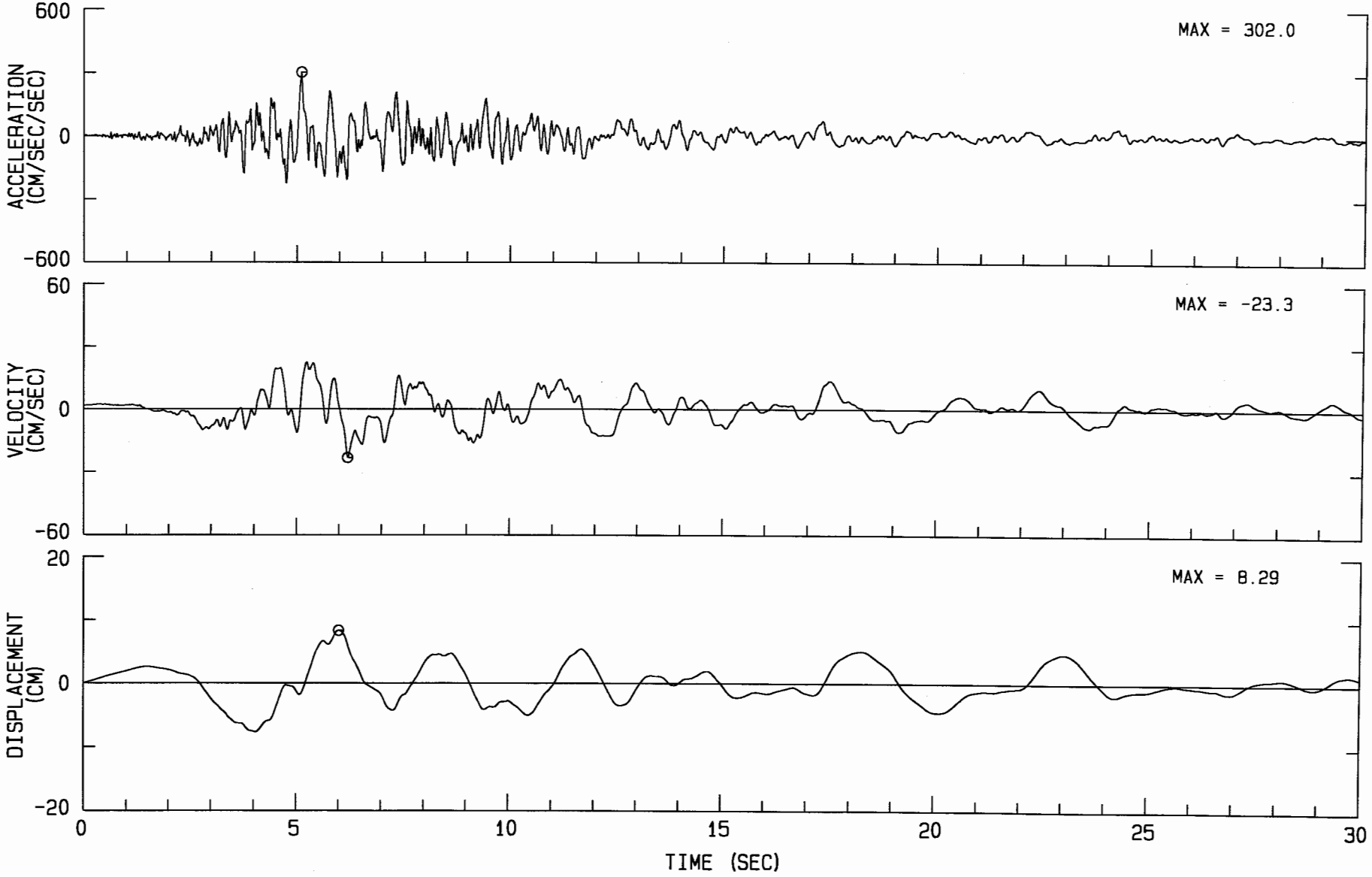


NORTHRIDGE EARTHQUAKE JANUARY 17, 1994 04:31 PST
ARLETA - NORDHOFF AVE FIRE STATION CHN 1: 90 DEG
INSTRUMENT-CORRECTED AND BANDPASS-FILTERED ACCELERATION, VELOCITY AND DISPLACEMENT
FILTER BAND: .06-.12 TO 23.0-25.0 HZ. 24087-S1594-94017.02 020394.1759-QN94A087

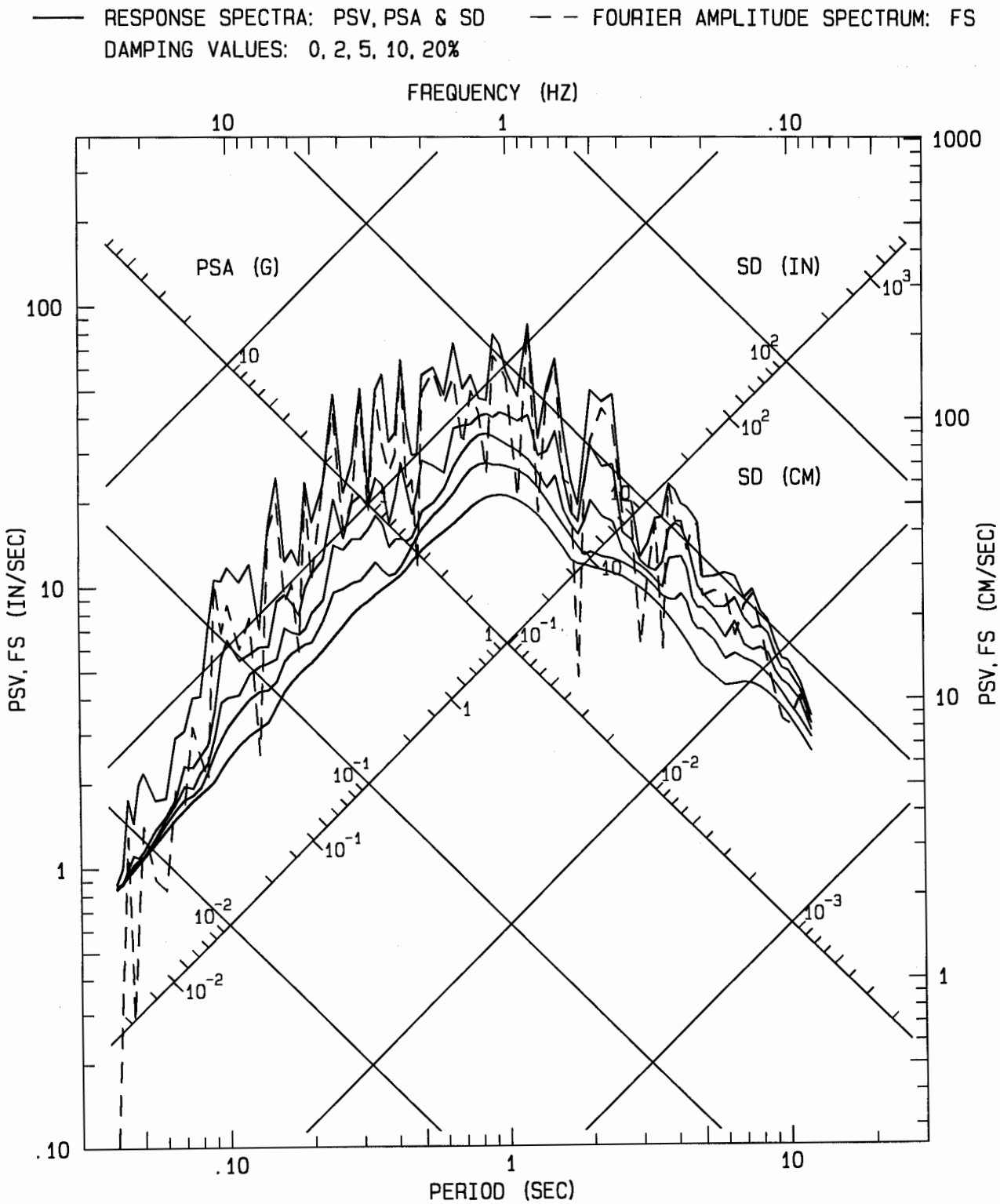



NORTHRIDGE EARTHQUAKE JANUARY 17, 1994 04:31 PST
ARLETA - NORDHOFF AVE FIRE STATION CHN 2: UP
INSTRUMENT-CORRECTED AND BANDPASS-FILTERED ACCELERATION, VELOCITY AND DISPLACEMENT
FILTER BAND: .06-.12 TO 23.0-25.0 HZ. 24087-S1594-94017.02 020394.1759-QN94A087
ACCELERATION (CM/SEC/SEC)
600
0
-600
MAX = -541.4
VELOCITY (CM/SEC)
60
0
-60
MAX = -17.5
DISPLACEMENT (CM)
20
0
-20
MAX = -6.45
0
5
10
15
20
25
30
TIME (SEC)

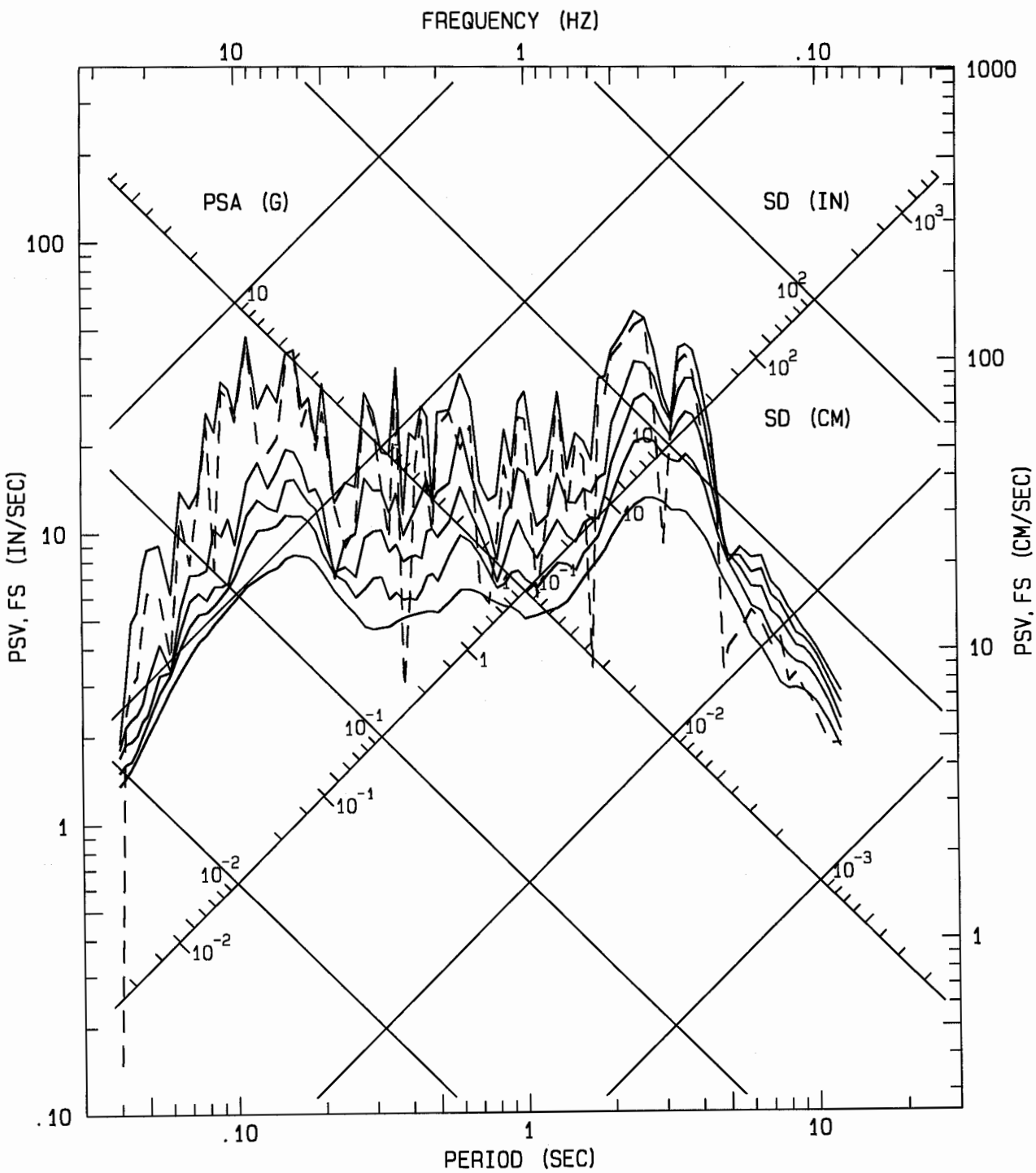
NORTHRIDGE EARTHQUAKE JANUARY 17, 1994 04:31 PST
ARLETA - NORDHOFF AVE FIRE STATION CHN 3: 360 DEG
INSTRUMENT-CORRECTED AND BANDPASS-FILTERED ACCELERATION, VELOCITY AND DISPLACEMENT
FILTER BAND: .06-.12 TO 23.0-25.0 HZ. 24087-S1594-94017.02 020394.1759-QN94A087



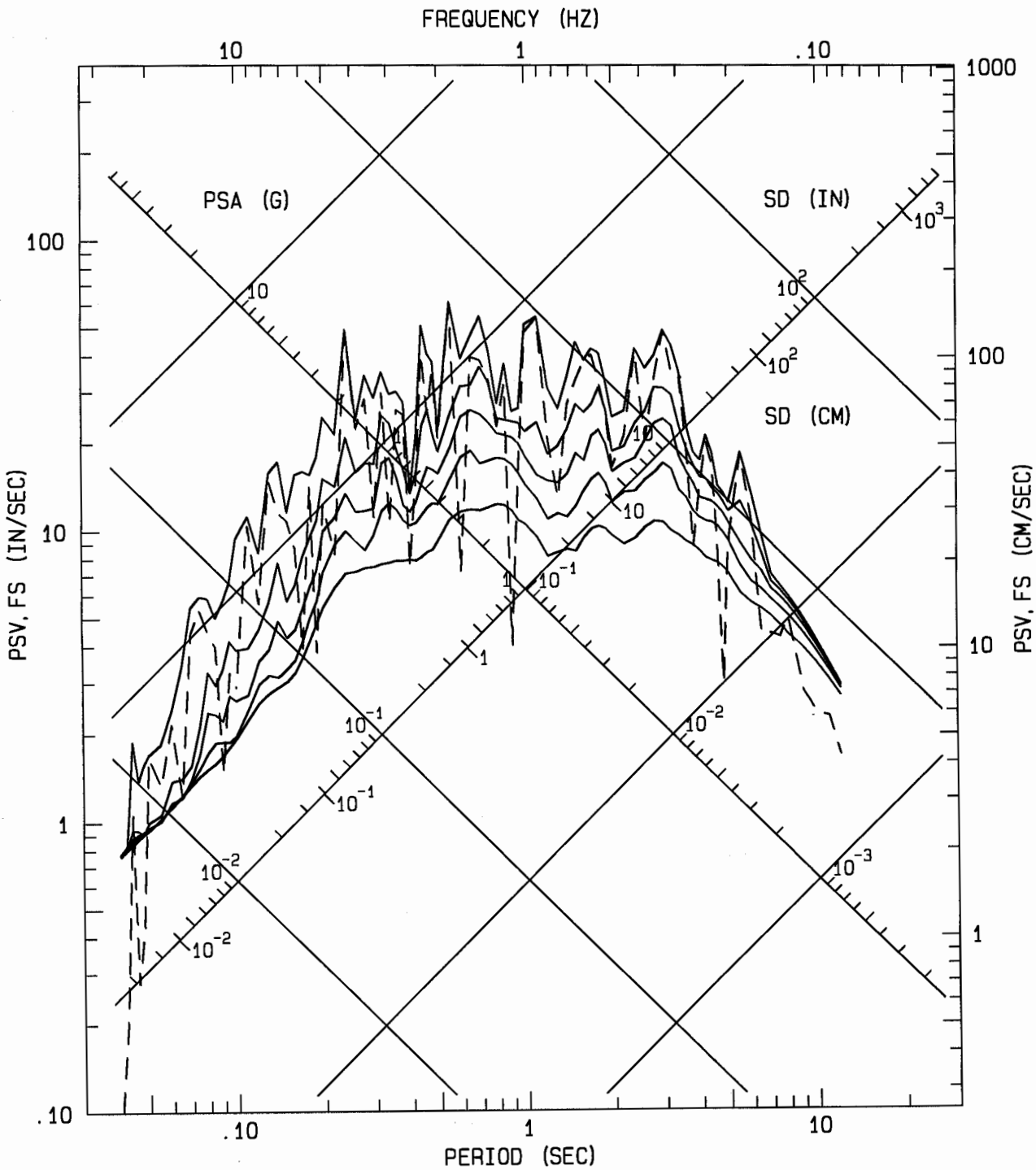
NORTHRIDGE EARTHQUAKE JANUARY 17, 1994 04:31 PST
ARLETA - NORDHOFF AVE FIRE STATION
CHN 1: 90 DEG
ACCELEROGRAM BANDPASS-FILTERED WITH RAMPS AT .06-.12 TO 23.0-25.0 HZ.
24087-S1594-94017.02 020494.0848-QN94A087



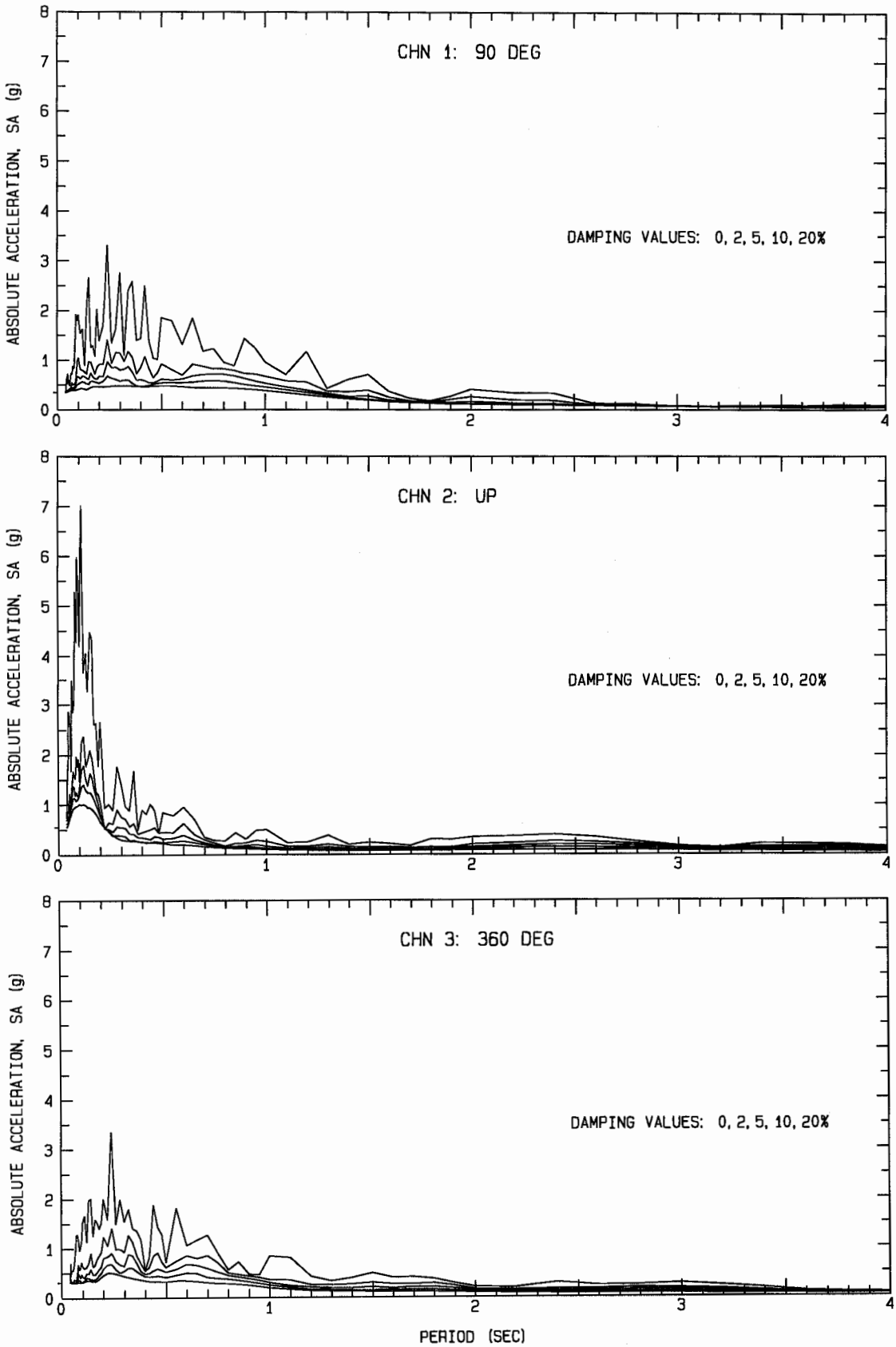
NORTHRIDGE EARTHQUAKE JANUARY 17, 1994 04:31 PST
ARLETA - NORDHOFF AVE FIRE STATION
CHN 2: UP
ACCELEROGRAM BANDPASS-FILTERED WITH RAMPS AT .06-.12 TO 23.0-25.0 HZ.
24087-S1594-94017.02 020494.0848-QN94A087



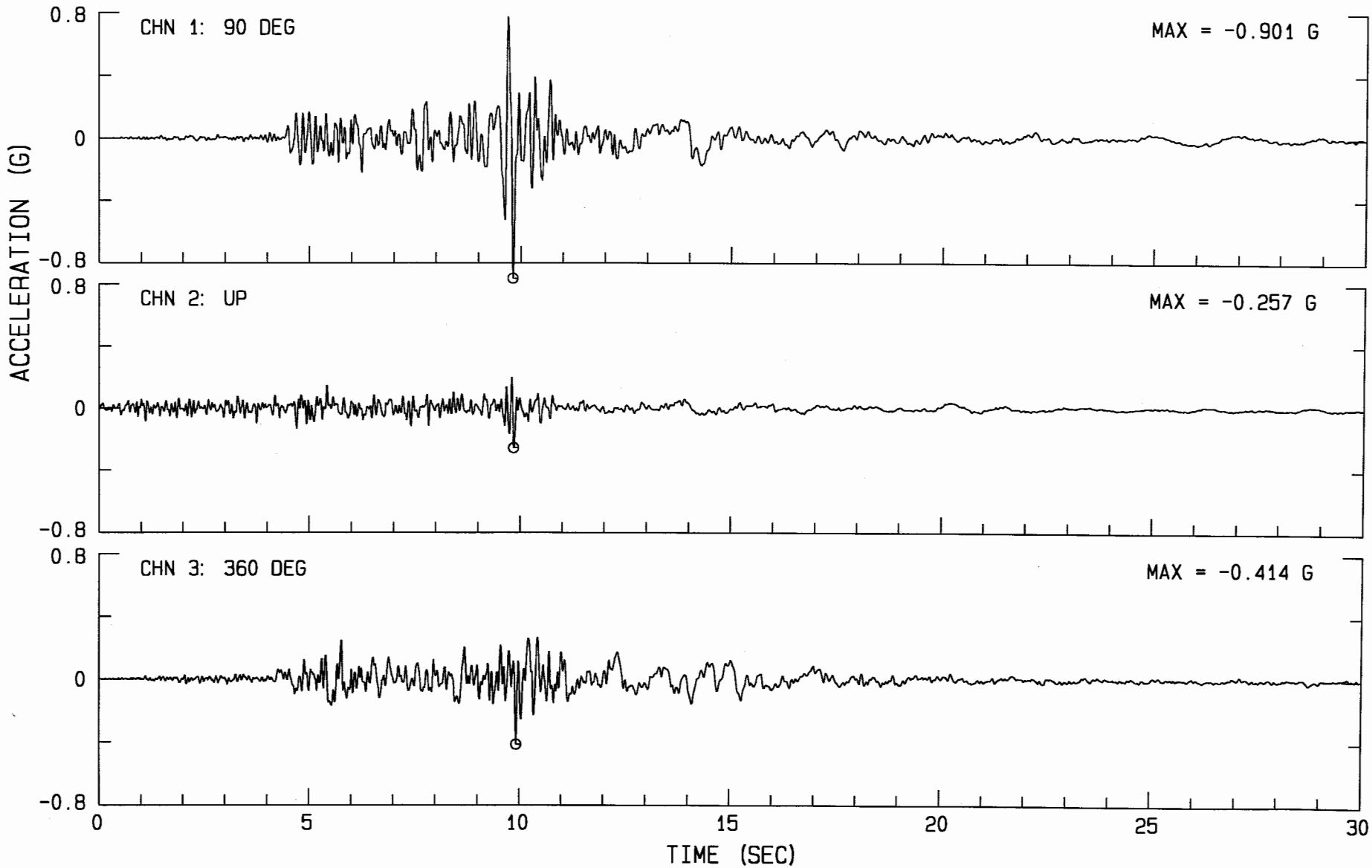
NORTHRIDGE EARTHQUAKE JANUARY 17, 1994 04:31 PST
ARLETA - NORDHOFF AVE FIRE STATION
CHN 3: 360 DEG
ACCELEROGRAM BANDPASS-FILTERED WITH RAMPS AT .06-.12 TO 23.0-25.0 HZ.
24087-S1594-94017.02 020494.0848-QN94A087



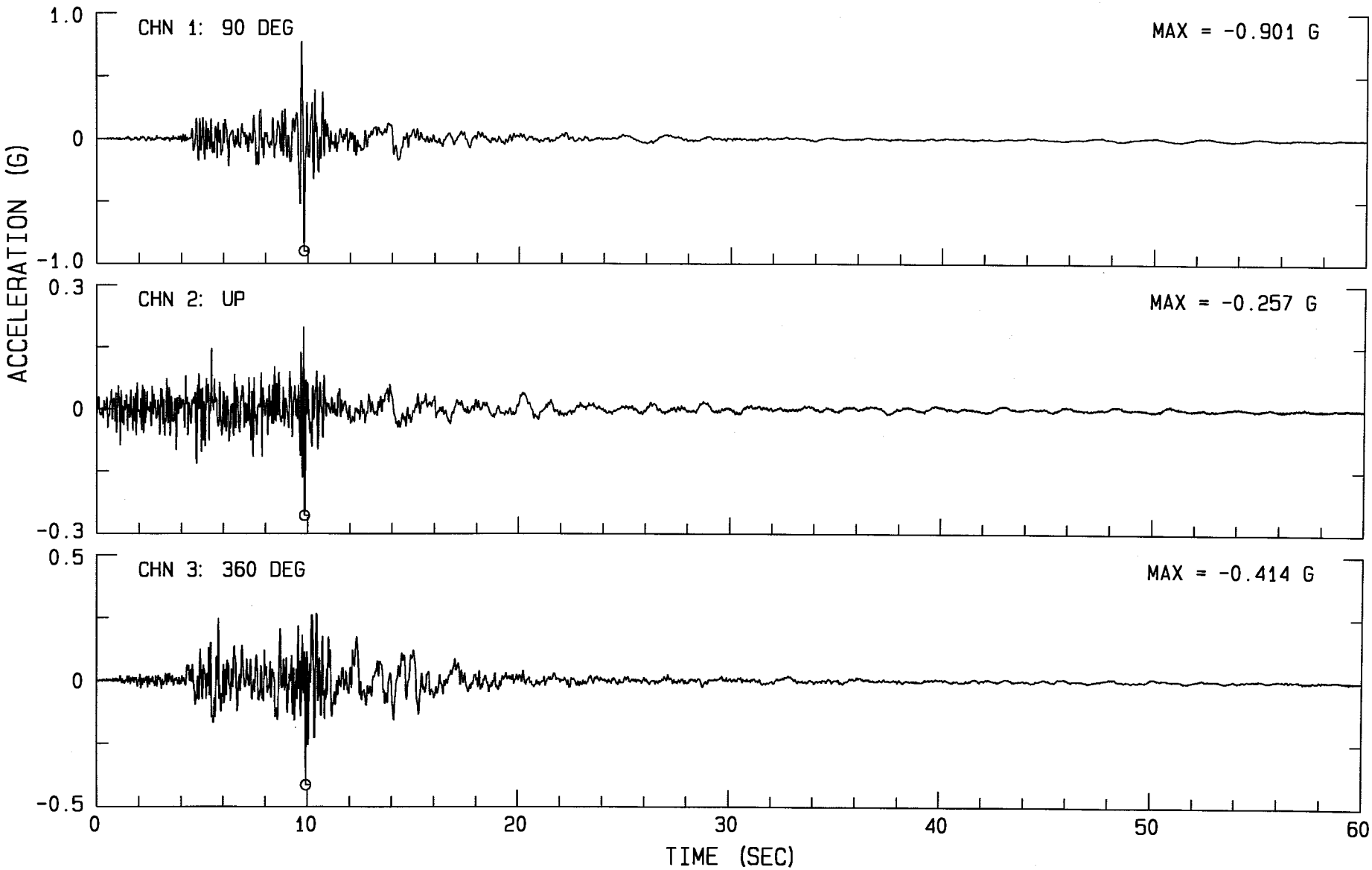
NORTHRIDGE EARTHQUAKE JANUARY 17, 1994 04:31 PST
ARLETA - NORDHOFF AVE FIRE STATION
ACCELEROGRAM BANDPASS-FILTERED WITH RAMPS AT .06-.12 TO 23.0-25.0 HZ.
24087-S1594-94017.02 020494.0848-QN94A087



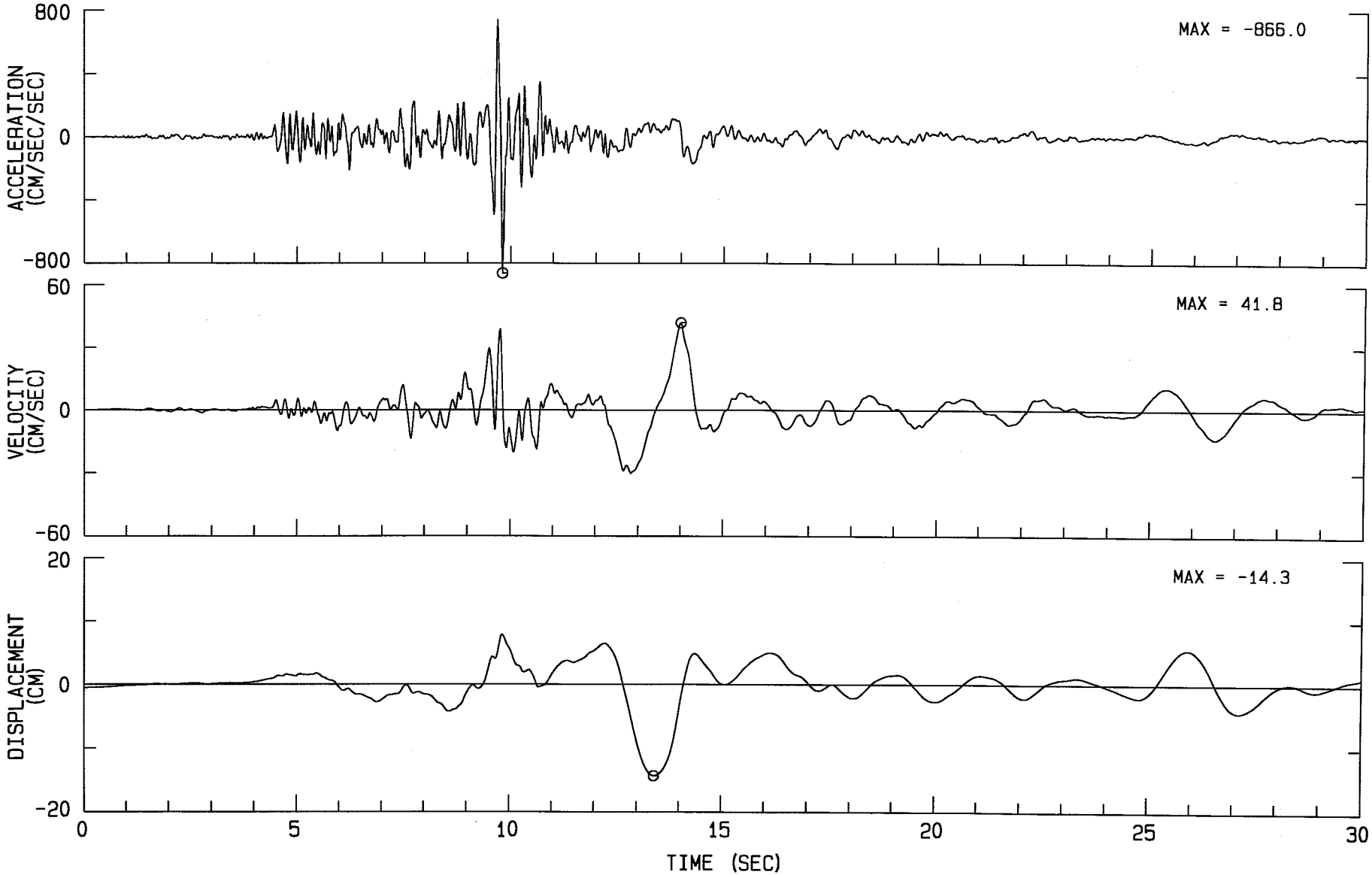
NORTHRIDGE EARTHQUAKE JANUARY 17, 1994 04:31 PST
SANTA MONICA - CITY HALL GROUNDS
UNCORRECTED ACCELEROGRAM 24538-S2486-94020.06 012894.1248-QN94A538



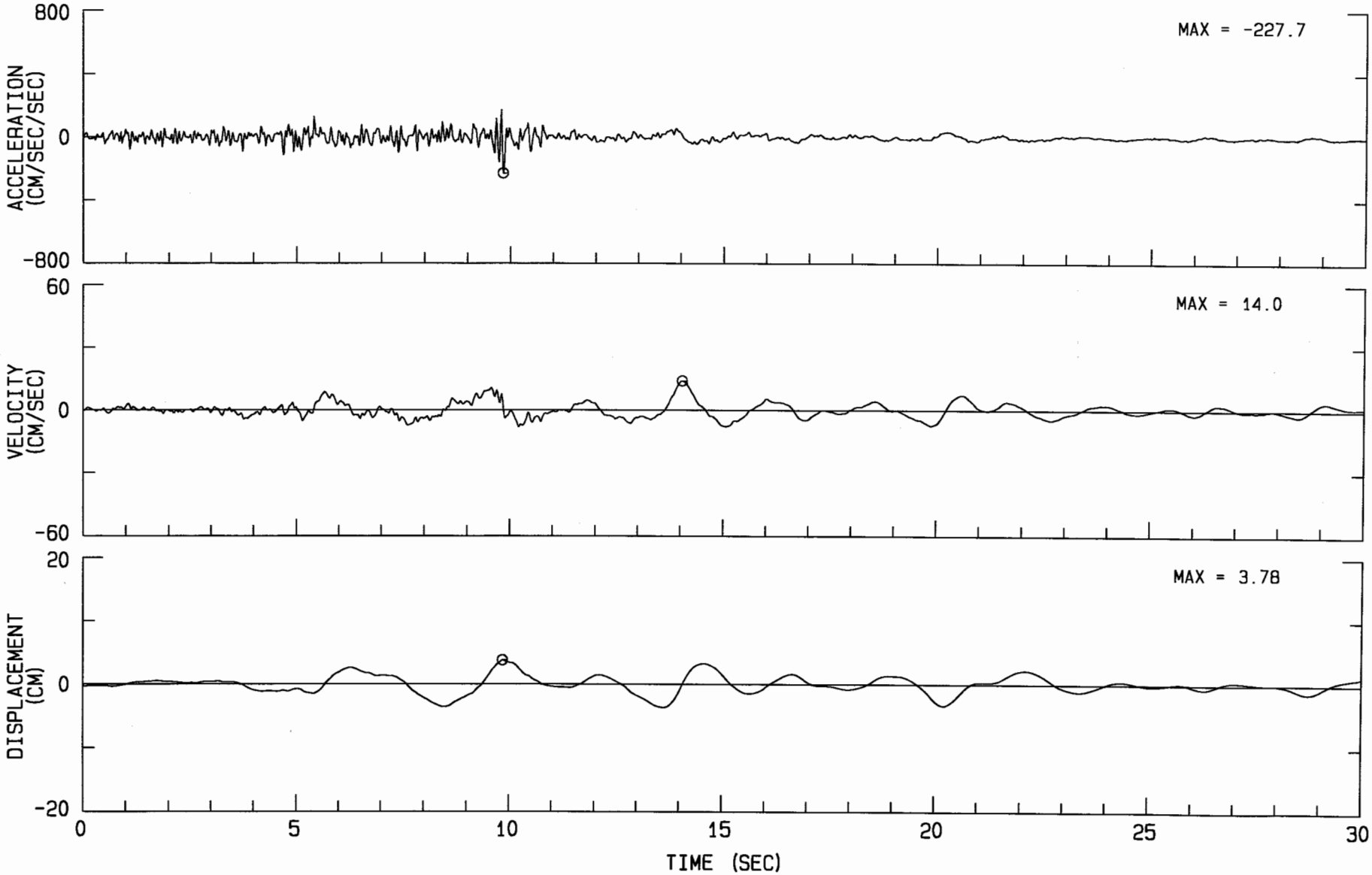
NORTHRIDGE EARTHQUAKE JANUARY 17, 1994 04:31 PST
SANTA MONICA - CITY HALL GROUNDS
UNCORRECTED ACCELEROGRAM 24538-S2486-94020.06 012894.1248-QN94A538



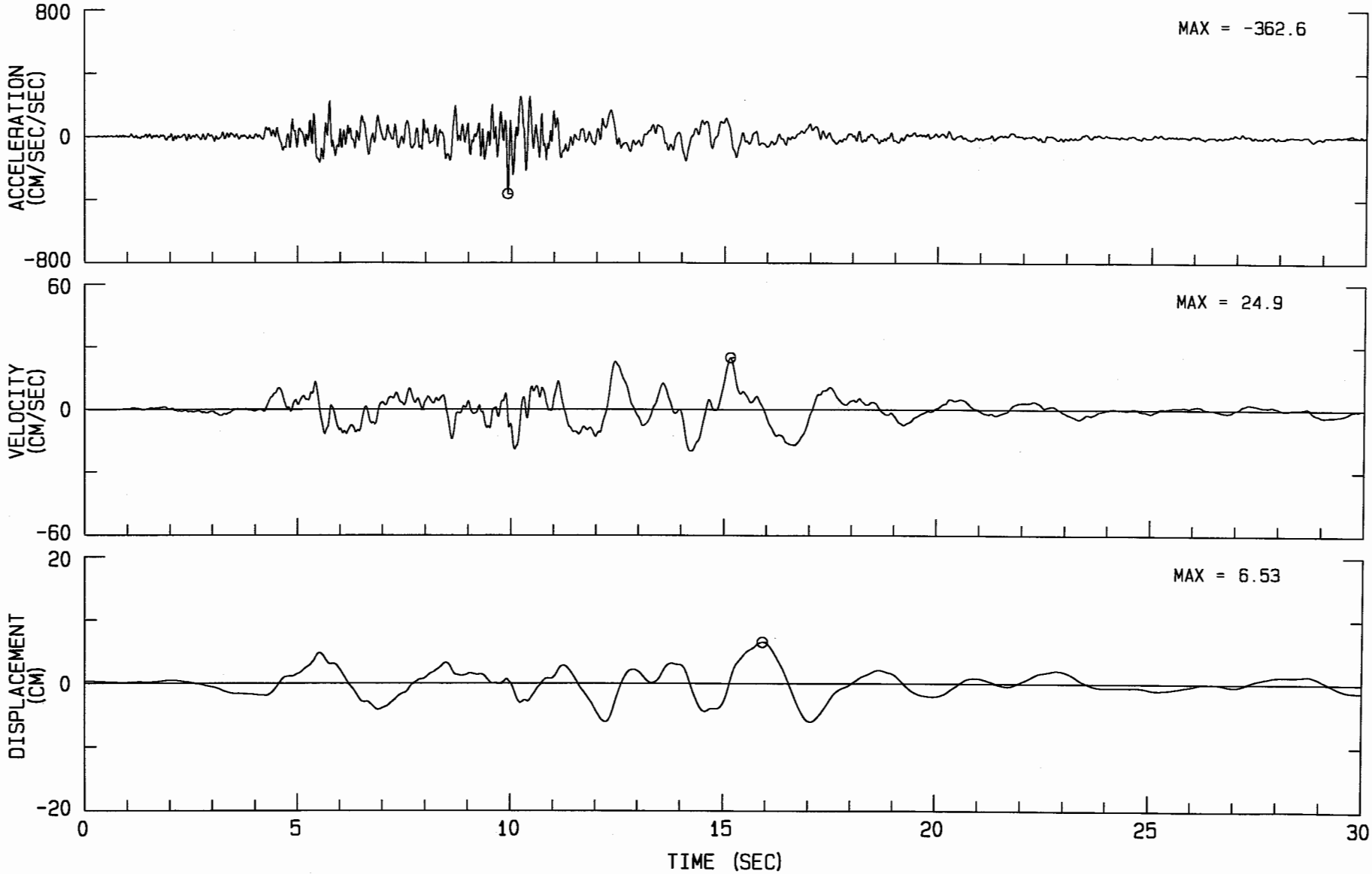
NORTHRIDGE EARTHQUAKE JANUARY 17, 1994 04:31 PST
SANTA MONICA - CITY HALL GROUNDS CHN 1: 90 DEG
INSTRUMENT-CORRECTED AND BANDPASS-FILTERED ACCELERATION, VELOCITY AND DISPLACEMENT
FILTER BAND: .07-.14 TO 23.0-25.0 HZ. 24538-S2486-94020.06 020494.0914-QN94A538



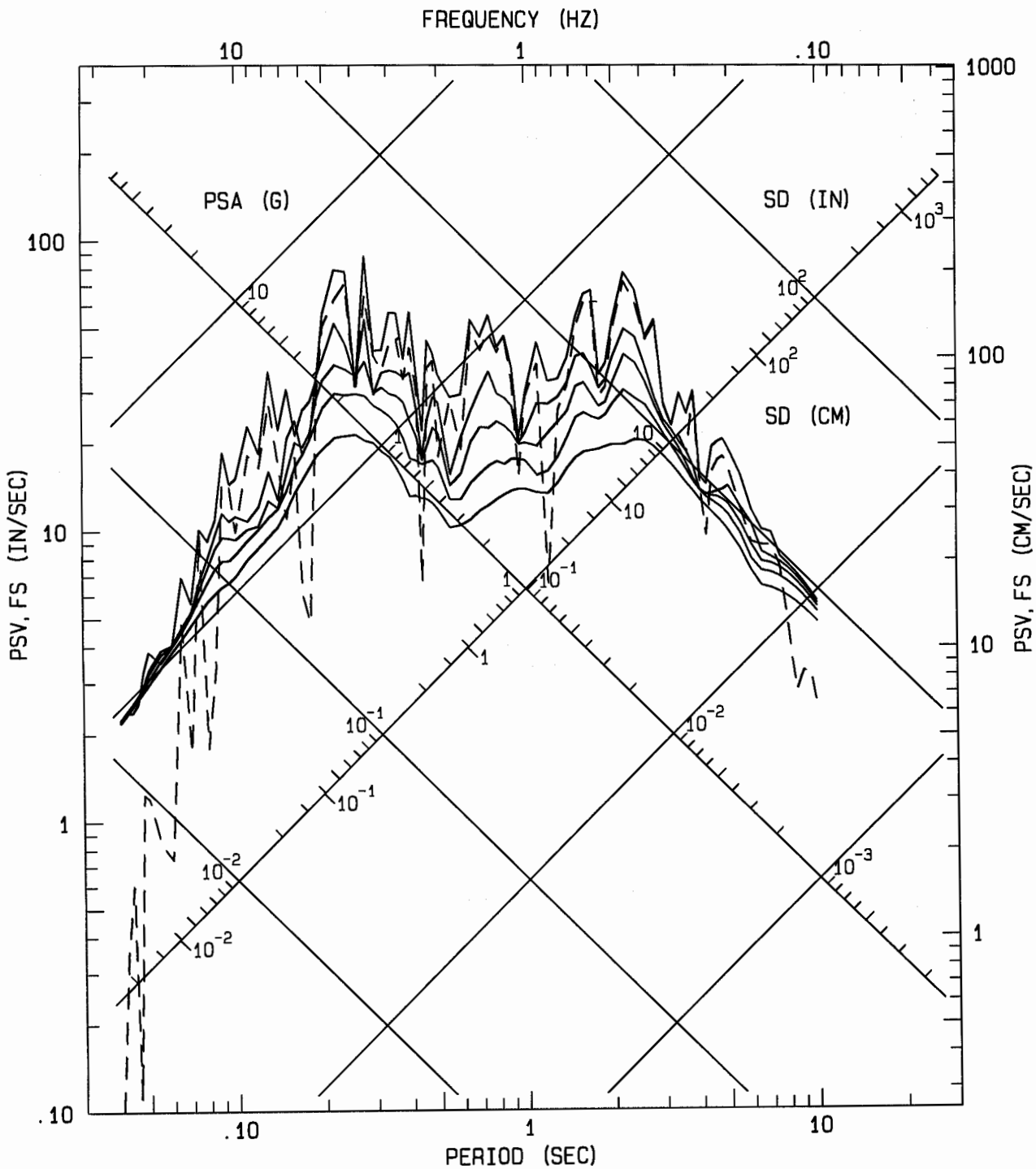
NORTHRIDGE EARTHQUAKE JANUARY 17, 1994 04:31 PST
SANTA MONICA - CITY HALL GROUNDS CHN 2: UP
INSTRUMENT-CORRECTED AND BANDPASS-FILTERED ACCELERATION, VELOCITY AND DISPLACEMENT
FILTER BAND: .07-.14 TO 23.0-25.0 HZ. 24538-S2486-94020.06 020494.0914-QN94A538



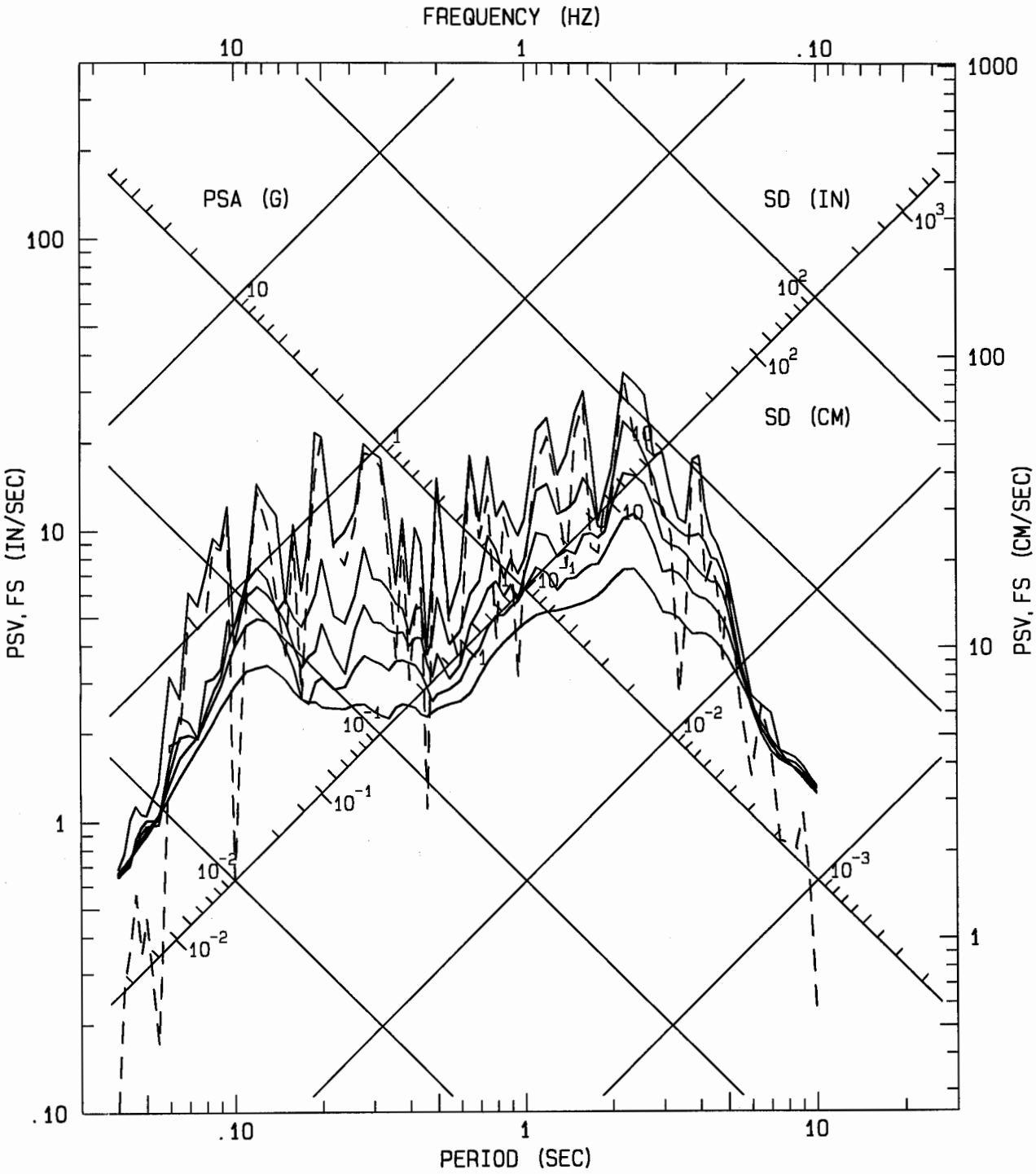
NORTHRIDGE EARTHQUAKE JANUARY 17, 1994 04:31 PST
SANTA MONICA - CITY HALL GROUNDS CHN 3: 360 DEG
INSTRUMENT-CORRECTED AND BANDPASS-FILTERED ACCELERATION, VELOCITY AND DISPLACEMENT
FILTER BAND: .07-.14 TO 23.0-25.0 HZ. 24538-S2486-94020.06 020494.0914-QN94A538



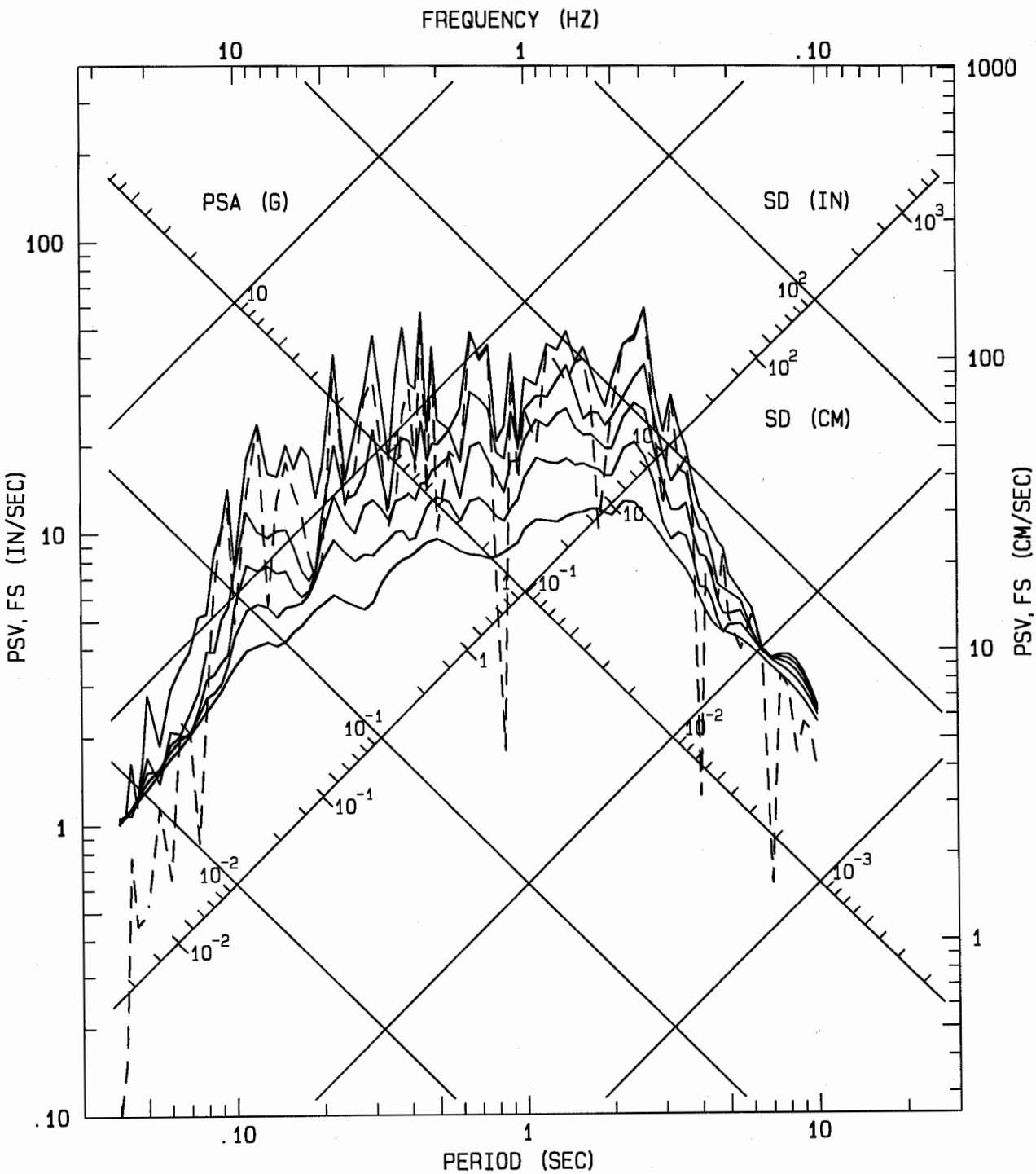
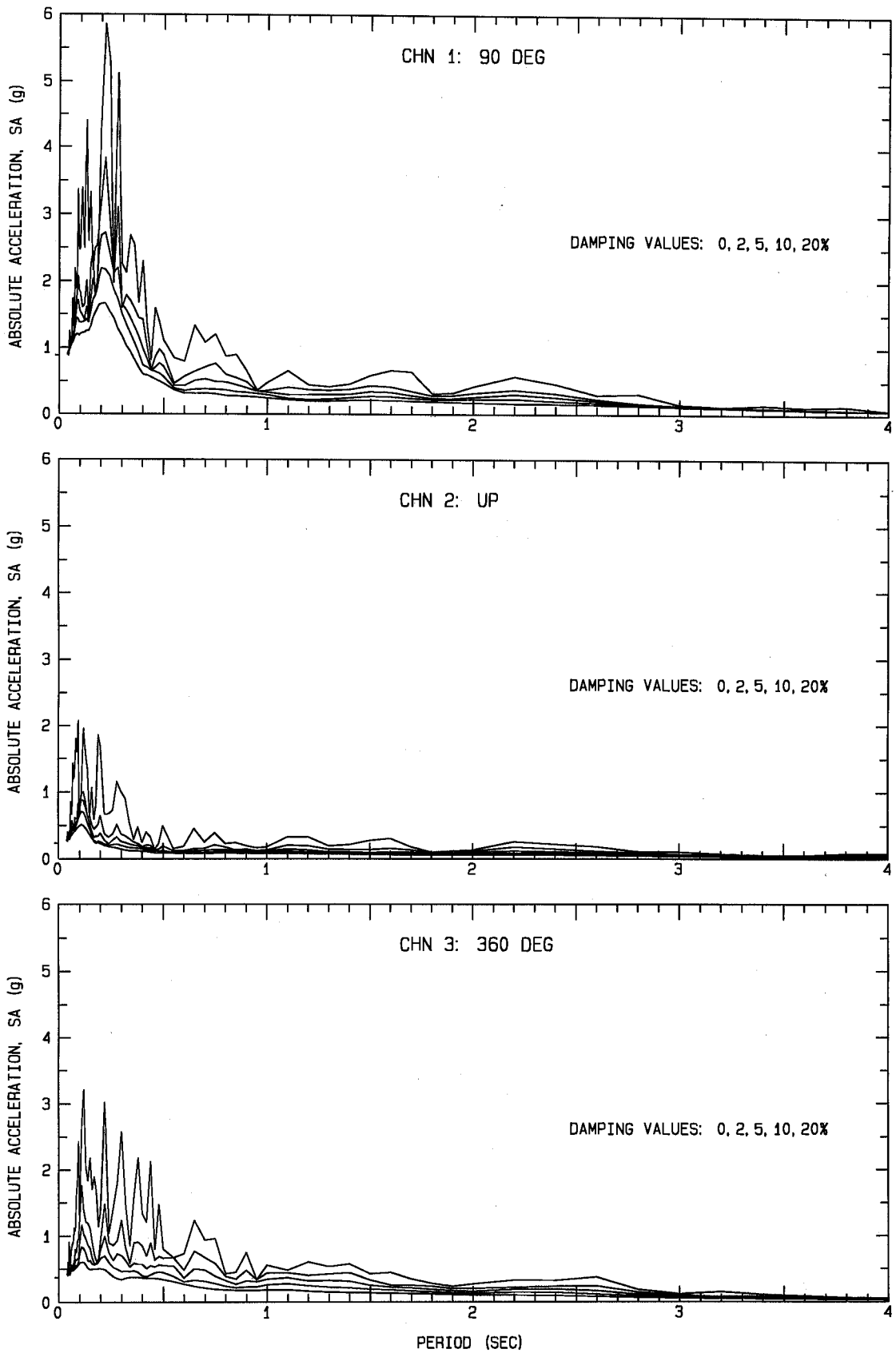
NORTHRIDGE EARTHQUAKE JANUARY 17, 1994 04:31 PST
SANTA MONICA - CITY HALL GROUNDS
CHN 1: 90 DEG
ACCELEROGRAM BANDPASS-FILTERED WITH RAMPS AT .07-.14 TO 23.0-25.0 HZ.
24538-S2486-94020.06 020494.1006-QN94A538



NORTHRIDGE EARTHQUAKE JANUARY 17, 1994 04:31 PST
SANTA MONICA - CITY HALL GROUNDS
CHN 2: UP
ACCELEROGRAM BANDPASS-FILTERED WITH RAMPS AT .07-.14 TO 23.0-25.0 HZ.
24538-S2486-94020.06 020494.1006-QN94A538



NORTHRIDGE EARTHQUAKE JANUARY 17, 1994 04:31 PST
SANTA MONICA - CITY HALL GROUNDS
CHN 3: 360 DEG
ACCELEROGRAM BANDPASS-FILTERED WITH RAMPS AT .07-.14 TO 23.0-25.0 HZ.
24538-S2486-94020.06 020494.1006-QN94A538



NORTHRIDGE EARTHQUAKE JANUARY 17, 1994 04:31 PST
SANTA MONICA - CITY HALL GROUNDS
ACCELEROGRAM BANDPASS-FILTERED WITH RAMPS AT .07-.14 TO 23.0-25.0 HZ.
24538-S2486-94020.06 020494.1006-QN94A538